LAWRENCE COUNTY SOILS

SOIL REPORT 78

UNIVERSITY OF ILLINOIS
AGRICULTURAL EXPERIMENT STATION

COVER PICTURE

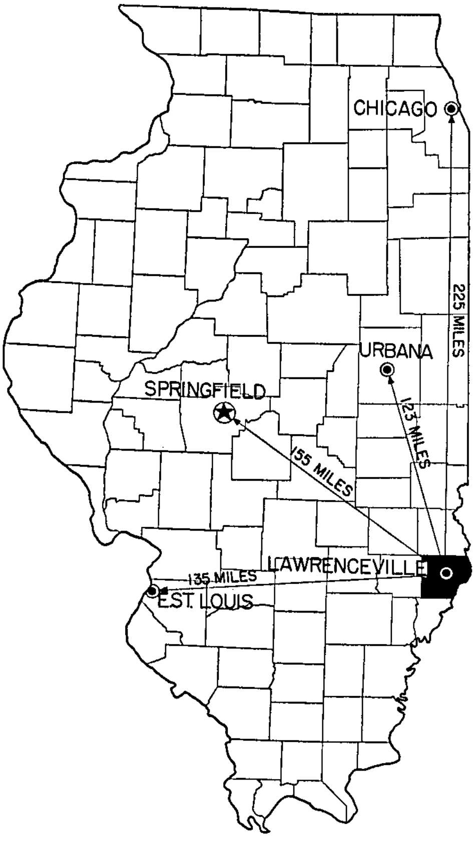
The picture on the cover of this report is a view from the air of the western part of Lawrenceville, the county seat of Lawrence county, and of the surrounding countryside.

Three general levels or elevations are shown: bottomland, terraces or second bottoms, and upland. Each level has different kinds or types of soils.

The straightened channel of the Embarrass river cuts across the upper right portion of the picture, and the winding oxbows or sloughs of the old channel are still evident.

Highways U. S. 50 and Alternate U. S. 50 run through the southwest portion of the picture and converge near the west edge of town. Near the lower right margin, Route 1 intersects Route 50 and runs north and south across the Embarrass.

(Picture supplied by
Agricultural Conservation and Stabilization Service,
U. S. Department of Agriculture)



Lawrence county lies in southeastern Illinois along the Wabash river, which marks the state boundary. Lawrenceville, the county seat, is 155 miles from Springfield and 123 miles from Urbana.

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Urbana, Illinois April, 1956

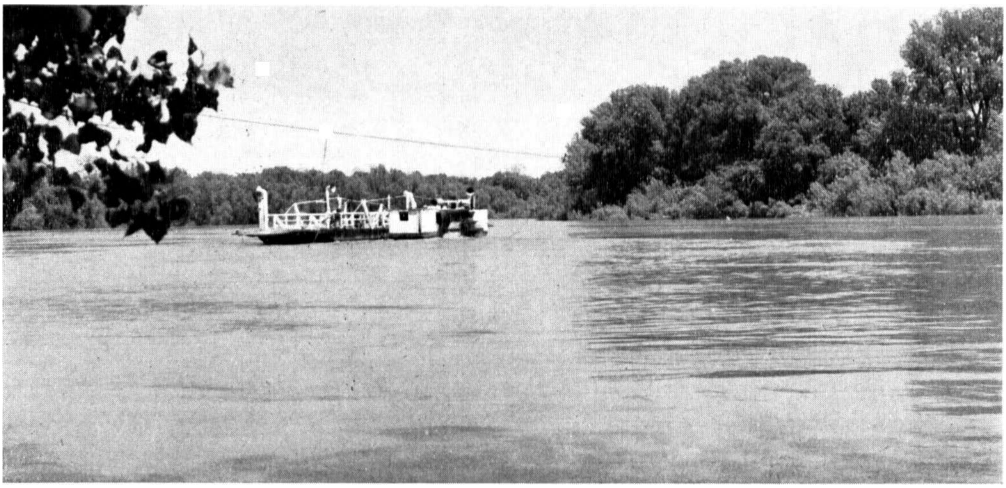
LAWRENCE COUNTY SOILS

By J. B. Fehrenbacher and R. T. Odell

THIS SOIL REPORT has been prepared to help answer these questions about the soils of Lawrence county: *What soils occur in the county? On what slopes do they occur and how seriously have they been damaged by erosion? How should they be managed? What crops are adapted to each soil? How much will they yield?* The soil map shows the extent and location of the various soils of the county. The text includes descriptions of the soil types and discussions of their proper use, management, and crop-producing capacity.

Lawrence county lies in southeastern Illinois. It is bordered on the east by the Wabash river and Indiana. The early history of Lawrence county is closely related to that of Vincennes, Indiana, which was one of the earliest white settlements in the Middle West. Lawrence was organized as a separate county on January 16, 1821. Later, on February 24, 1841, the western portion of Lawrence county became a part of the then newly organized Richland county. The boundaries of Lawrence county have remained unchanged since that date.

Lawrence county has a total area of about 239,000 acres. The total population of the county in 1950 was 20,539 and that of Lawrenceville, the county seat and largest town, was 6,328. Transportation facilities, including roads and railroads, are well established in this area.



Wabash river ferry at St. Francisville. Lawrence county soils have been strongly influenced by sediments brought down from the north by the Wabash and Embarrass rivers. Even on the upland most of the soils have developed from a silty wind-blown deposit called loess which had its origin on the flood plains of these two rivers. (Fig. 1)

HOW TO USE THE SOIL MAP AND SOIL REPORT

Examine the Soil Map

The soil map of Lawrence county consists of three sheets. On the back of each is indicated the part of the county that it covers.

Meaning of colors and symbols. General soil conditions are indicated by broad color groups on the soil map. Various shades of *gray* are used for the light-colored upland soils developed from thin loess under grass vegetation. Shades of *yellow, orange,* and *brown* are used for the light-colored upland and terrace soils that developed mostly from loess under forest vegetation. Yellow of different shades is used for the westernmost belt of these soils, where loess is thinnest, and the soils are most highly weathered. Orange shades indicate the intermediate belt; and shades of brown, the first belt west of the Wabash river bottomlands, where the loess is thickest and the soils are the least weathered.

Dark-colored, medium-textured upland and terrace soils are shown in shades of *blue.* Sandy soils, most of which occur on terraces, are shown in two general groups, the dark-colored soils being indicated by shades of *purple* and the light-colored soils by shades of *pink.* Bottomland soils are shown in shades of *green.*

Soil types are subdivided into smaller mapping units on the basis of slope and thickness of remaining surface and subsurface soil. Each mapping unit is indicated by a symbol consisting of two or three parts: *First,* the soil type number; *second,* a capital letter indicating the slope group; and *third,* a dash above or below the slope group letter to indicate the thickness of remaining surface and subsurface soil (absence of a dash indicates little or no erosion). For example, $14\overline{\text{C}}$ is the symbol used for Ava silt loam (indicated by the "14"), where the slope is 4 to 7 percent (indicated by the "C"), and where there are 3 to 7 inches of surface and subsurface soil (indicated by the bar above the letter). Where a plus sign (+) follows the slope group letter, it means that light-colored silty sediment, 8 to 15 inches thick, has been deposited on a normal surface soil. The same color is used on the map for all areas of a given soil type, regardless of slope or erosion symbol. *The various soil type names, soil type numbers, and the meanings of the slope group letters and erosion symbols are given in the legend on each map sheet.*

Locating a farm on the map. To help in finding a particular farm or tract of land, many cultural features such as roads, railroads, towns, and farmhouses are indicated. Section boundaries, section numbers, township and range numbers, and physical features such as streams are also shown. If the legal description is known, a tract of land can be located easily by using township and range and section numbers. Otherwise, you can start with a recognized point, such as a town or crossroad, and if you know the distance and direction of a tract of land, you can easily find it.

Study Your Soils

After you have identified the mapping units on the farm you are interested in, turn to the index, page 5, to find where each soil type is described and where the use and management of each mapping unit is discussed.

INDEX TO SOIL TYPE DESCRIPTIONS AND USE AND MANAGEMENT RECOMMENDATIONS

Look first in the left-hand column for the symbols that match those given for your land on the colored map. After finding the symbols you are interested in, continue the line across the table, noting the page on which the soil type is described, the use-and-management group into which the mapping unit falls, and then the page where recommendations for that group are given.

Mapping unit	*Soil type description, page*	*Use and management*	
		Group No.	*Page*
2A	10	1	39
3A	10	1	39
3B, 3B̄, 3C̄	10	10	53
4B, 4C	11	10	53
5C, 5C̄, 5C̲	12	10	53
5D̄, 5D̲	12	12	58
8D̲, 8E̲, 8F̄, 8F̲	12	12	58
8-14C̲	13	10	53
8-14D̄, 8-14D̲, 8-14Ē, 8-14E̲, 8-14F̄, 8-14F̲	13	12	58
8-214D̄, 8-214D̲, 8-214Ē, 8-214E̲, 8-214F̄	13	12	58
8-308D̲, 8-308Ē, 8-308E̲, 8-308F̄	13	12	58
12A	13	1	39
13A	14	1	39
13B, 13B̄	14	10	53
14B, 14C, 14C̄, 14C̲	14	10	53
14D, 14D̄, 14D̲	14	12	58
46A	15	4	44
50A, 50A+	15	5	46
53A, 53B̲	16	14	61
53C, 53C̄, 53D, 53D̄	16	17	65
70A, 70A+	16	5	46
71A, 71A+	17	6	48
72A	18	7	49
75A, 75B	18	7	49
83A, 83A+	18	6	48
88A, 88B, 88C	18	15	63
92A, 92B	19	17	65
107A, 107A+	20	5	46
108A	20	8	50
109A	20	1	39
116A	21	2	42
120A, 120B, 120B̄	21	9	52
125A, 125A+	22	4	44
126A, 126A+	22	5	46
132A, 132A+	22	2	42
132B, 132B̄	22	11	55
134A	23	3	43
134B, 134B̄, 134C, 134C̄, 134C̲	23	11	55
134D̄, 134D̲	23	12	58
142A, 142A+	23	5	46
148A	23	3	43
155A, 155B̄	24	15	63
155C̄, 155C̲	24	16	65
155D̲	24	17	65
164A	24	1	39
164B, 164B̄	24	10	53
165A	24	1	39
167B	25	10	53
168A	25	1	39
169A	25	1	39
169B, 169B̄, 169C̄	25	10	53
170A, 170B	26	4	44
173A	26	1	39
173B, 173B̄, 173C̄, 173C̲	26	10	53
174A	26	13	60
174B, 174C̄	26	14	61
175A, 175B̲, 175C, 175C̄	27	14	61
175C̲, 175D̄	27	16	65
176A, 176A+	27	4	44
178A, 178A+	28	13	60
184A	28	13	60
184B	28	14	61
186A, 186B̲, 186C, 186C̄	28	14	61
186D, 186D̄	28	16	65
186D̲, 186E, 186Ē, 186E̲, 186F̄	28	17	65
187A, 187A+	29	13	60
200A	29	4	44
208A, 208A+	29	2	42
214B, 214B̄, 214C, 214C̄, 214C̲	30	10	53
214D̄, 214D̲, 214Ē, 214E̲	30	12	58
253A, 253B	30	16	65
253B̄, 253B̲, 253C̄, 253C̲, 253D̄, 253D̲	30	17	65
284A	31	5	46
285A, 285B	31	15	63
286A, 286B, 286B̄, 286C, 286C̄	32	15	63
287A, 287A+	32	1	39
288A, 288A+	32	8	50
289A, 289A+	33	15	63
300A, 300A+	33	5	46
302A	33	5	46
303A	34	5	46
304A	34	7	49
305A, 305B	35	15	63
306A	35	7	49
307A	35	2	42
307B, 307B̄	35	11	55
308A	36	3	43
308B, 308B̄, 308C, 308C̄, 308C̲	36	11	55
308D̄, 308D̲, 308Ē, 308E̲	36	12	58
309A, 309B, 309C̄, 309C̲, 309D̄	36	9	52
331A	36	7	49
332A, 332B	37	15	63
333A	37	8	50
334A	37	8	50
382A	38	8	50

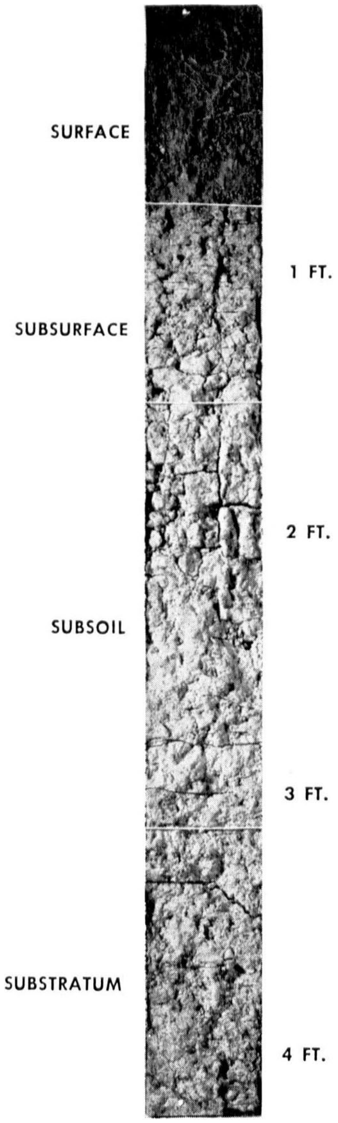
Entire soil profile is important. In studying the soil type descriptions note particularly that soils are separated into types on the basis of their characteristics to a depth of 40 inches or more, *not on surface character alone* (Fig. 2). The surface layer of one type may be little or no different from that of another; yet the two types may differ widely in agricultural value because of differences in subsurface or subsoil. The nature of the subsoil is important in determining the drainability and water-supplying power of most soils, especially during critical periods of excess rainfall or drouth.

Variations occur within each type. It is also important to understand that each soil type includes a range in properties, and that the boundaries between soil types are not necessarily sharp. Sometimes types are so intermingled that it is impossible to show them separately on the soil map. Hickory loam and Ava silt loam, in many areas of Lawrence county, are two such intermingled types. They are shown on the map as 8-14 and indicated in the legend as a complex.

Use and management recommendations. The different mapping units on the soil map have been combined into seventeen groups on the basis of similarities in use and management. Recommendations for using and managing each group are given on pages 38 to 66.

Test yields show results of good management. After you have studied the descriptions of your soil types and the recommended use and management of each mapping unit on your farm, you can check your present management program by comparing your yields with those obtained in tests.

On pages 66 to 68 you will find information on yields obtained with a moderately high level of management under farm conditions in Lawrence county. Results from the University of Illinois soil experiment fields that apply to Lawrence county are also given in Tables 8 through 11 to show that still higher yields are possible.



A soil profile of Cisne silt loam, a claypan soil that occurs in the western part of Lawrence county. The white horizontal lines show the separation between soil horizons. Horizons to a depth of 40 inches or more are important in determining soil productivity. (Fig. 2)

Table 1. — LAWRENCE COUNTY SOILS: Areas of the Different Types Grouped According to Slope and Erosion

Type No.	Type name	Percent of total area	Area in square miles	Area in acres	Acres of various slope and erosion groups						
					Erosion group	A slope 0-1.5%	B slope 1.5-4%	C slope 4-7%	D slope 7-12%	E slope 12-18%	F slope 18-30%
2	Cisne silt loam	2.12	7.94	5,082	None to slight	5,082	....	....	....	....	....
3	Hoyleton silt loam	2.24	8.37	5,357	None to slight	1,354	3,299	....	....	....	....
					Moderate	.....	298	406	....	....	....
4	Richview silt loam	.02	.07	43	None to slight	.....	28	15	....	....	....
5	Blair silt loam	1.22	4.54	2,907	None to slight	.....	....	143	....	....	....
					Moderate	.....	....	2,128	125	....	....
					Severe	.....	....	366	145	....	....
8	Hickory loam	.23	.86	548	Moderate	.....	....	....	....	....	26
					Severe	.....	....	....	138	327	57
8-14	Hickory loam-Ava silt loam, complex	3.41	12.76	8,168	Moderate	.....	....	....	309	624	208
					Severe	.....	....	394	5,033	1,450	150
8-214	Hickory loam-Hosmer silt loam, complex	.18	.66	421	Moderate	.....	....	....	110	50	36
					Severe	.....	....	....	132	93	....
8-308	Hickory loam-Alford silt loam, complex	.18	.67	431	Moderate	.....	....	....	....	127	236
					Severe	.....	....	....	41	27	....
12	Wynoose silt loam	1.29	4.83	3,088	None to slight	3,088	....	....	....	....	....
13	Bluford silt loam	12.14	45.40	29,057	None to slight	4,932	23,563	....	....	....	....
					Moderate	.....	562	....	....	....	....
14	Ava silt loam	10.51	39.30	25,154	None to slight	.....	5,117	2,981	230	....	....
					Moderate	.....	....	9,549	2,302	....	....
					Severe	.....	....	1,942	3,033	....	....
46	Herrick silt loam	.20	.75	482	None to slight	482	....	....	....	....	....
50	Virden silty clay loam	.17	.65	407	Silty deposition	28	....	....	....	....	....
					None to slight	379	....	....	....	....	....
53	Bloomfield fine sand	.65	2.43	1,554	None to slight	32	533	683	171	....	....
					Moderate	.....	....	64	71	....	....
70	Beaucoup silty clay loam, bottom	1.46	5.46	3,492	Silty deposition	75	....	....	....	....	....
					None to slight	3,417	....	....	....	....	....
71	Darwin clay, bottom	4.89	18.28	11,702	Silty deposition	1,092	....	....	....	....	....
					None to slight	10,610	....	....	....	....	....
72	Sharon loam, bottom	.44	1.65	1,056	None to slight	1,056	....	....	....	....	....
75	Drury silt loam	.11	.40	256	None to slight	187	69	....	....	....	....
83	Wabash silty clay, bottom	2.97	11.12	7,114	Silty deposition	380	....	....	....	....	....
					None to slight	6,734	....	....	....	....	....
88	Hagener loamy sand	.43	1.61	1,030	None to slight	366	556	108	....	....	....
92	Perks sand, bottom	.17	.64	409	None to slight	74	335	....	....	....	....
107	Sawmill silty clay loam, bottom	.91	3.40	2,173	Silty deposition	48	....	....	....	....	....
					None to slight	2,125	....	....	....	....	....
108	Bonnie silt loam, bottom	.49	1.83	1,170	None to slight	1,170	....	....	....	....	....
109	Racoon silt loam	.92	3.44	2,204	None to slight	2,204	....	....	....	....	....
116	Whitson silt loam	.04	.17	106	None to slight	106	....	....	....	....	....
120	Huey silt loam	.17	.62	394	None to slight	224	17	....	....	....	....
					Moderate	.....	153	....	....	....	....

(Table 1 is continued on pages 8 and 9.)

Table 1. — Continued

Type No.	Type name	Percent of total area	Area in square miles	Area in acres	Acres of various slope and erosion groups						
					Erosion group	A slope 0-1.5%	B slope 1.5-4%	C slope 4-7%	D slope 7-12%	E slope 12-18%	F slope 18-30%
125	Selma loam	.43	1.60	1,021	Silty deposition	25	....	....	....	....	....
					None to slight	996	....	....	....	....	....
126	Bonpas silty clay loam	1.78	6.66	4,264	Silty deposition	711	....	....	....	....	....
					None to slight	3,553	....	....	....	....	....
132	Starks silt loam	1.70	6.37	4,075	Silty deposition	9	....	....	....	....	....
					None to slight	3,418	627	....	....	....	....
					Moderate	.....	21	....	....	....	....
134	Camden silt loam	.82	3.06	1,958	None to slight	197	752	35	....	....	....
					Moderate	.....	69	641	149	....	....
					Severe	.....	....	86	29	....	....
142	Patton silty clay loam	2.11	7.90	5,057	Silty deposition	386	....	....	....	....	....
					None to slight	4,671	....	....	....	....	....
148	Proctor silt loam	.33	1.25	801	None to slight	801	....	....	....	....	....
155	Stockland loam	.30	1.11	711	None to slight	47	....	....	....	....	....
					Moderate	.....	77	319	....	....	....
					Severe	.....	....	97	171	....	....
164	Stoy silt loam	2.21	8.27	5,291	None to slight	440	4,763	....	....	....	....
					Moderate	.....	88	....	....	....	....
165	Weir silt loam	.02	.09	58	None to slight	58	....	....	....	....	....
167	Lukin silt loam	.24	.90	578	None to slight	.....	578	....	....	....	....
168	Flora silt loam	.34	1.29	824	None to slight	824	....	....	....	....	....
169	Freeburg silt loam	.39	1.44	924	None to slight	289	471	....	....	....	....
					Moderate	.....	27	137	....	....	....
170	Breese silt loam	.42	1.58	1,008	None to slight	769	239	....	....	....	....
173	McGary silt loam	1.25	4.68	2,992	None to slight	2,048	197	....	....	....	....
					Moderate	.....	376	118	....	....	....
					Severe	.....	....	253	....	....	....
174	Cowling fine sandy loam	1.17	4.37	2,798	None to slight	2,082	697	....	....	....	....
					Moderate	.....	....	19	....	....	....
175	Unity sandy loam	.91	3.39	2,172	None to slight	356	1,290	284	....	....	....
					Moderate	.....	....	141	77	....	....
					Severe	.....	....	24	....	....	....
176	Marissa silt loam	1.69	6.33	4,050	Silty deposition	719	....	....	....	....	....
					None to slight	3,331	....	....	....	....	....
178	Ruark fine sandy loam	.48	1.81	1,160	Silty deposition	14	....	....	....	....	....
					None to slight	1,146	....	....	....	....	....
184	Roby fine sandy loam	.41	1.54	985	None to slight	733	252	....	....	....	....
186	Kincaid fine sandy loam	1.17	4.39	2,811	None to slight	42	706	534	111	40	....
					Moderate	.....	....	615	394	275	68
					Severe	.....	....	....	15	11	....
187	Milroy sandy loam	.76	2.84	1,818	Silty deposition	3	....	....	....	....	....
					None to slight	1,815	....	....	....	....	....
200	Orio sandy loam	.18	.67	431	None to slight	431	....	....	....	....	....
208	Sexton silt loam	.98	3.65	2,337	Silty deposition	100	....	....	....	....	....
					None to slight	2,237	....	....	....	....	....

Table 1. — Concluded

Type No.	Type name	Percent of total area	Area in square miles	Area in acres	Acres of various slope and erosion groups						
					Erosion group	A slope 0-1.5%	B slope 1.5-4%	C slope 4-7%	D slope 7-12%	E slope 12-18%	F slope 18-30%
214	Hosmer silt loam	2.96	11.05	7,073	None to slight	.....	1,582	872	....	....	....
					Moderate	.....	31	3,213	415	76	....
					Severe	.....	....	413	436	35	....
253	Stonington soils	.18	.66	423	None to slight	110	109	....	....	....	....
					Moderate	.....	13	56	42	....	....
					Severe	.....	7	40	46	....	....
284	Tice silty clay loam, bottom	.62	2.33	1,491	None to slight	1,491	....	....	....	....	....
285	Carmi loam	5.39	20.14	12,891	None to slight	12,267	624	....	....	....	....
286	Carmi sandy loam	1.72	6.42	4,111	None to slight	486	3,058	148	....	....	....
					Moderate	.....	60	359	....	....	....
287	Chauncey silt loam	.74	2.76	1,769	Silty deposition	10	....	....	....	....	....
					None to slight	1,759	....	....	....	....	....
288	Petrolia silty clay loam, bottom	2.93	10.96	7,016	Silty deposition	136	....	....	....	....	....
					None to slight	6,880	....	....	....	....	....
289	Omaha loam	1.73	6.48	4,146	Silty deposition	25	....	....	....	....	....
					None to slight	4,121	....	....	....	....	....
300	Abington clay loam	.70	2.60	1,666	Silty deposition	13	....	....	....	....	....
					None to slight	1,653	....	....	....	....	....
302	Ambraw clay loam, bottom	.23	.87	556	None to slight	556	....	....	....	....	....
303	Sawmill clay loam, bottom	.15	.57	365	None to slight	365	....	....	....	....	....
304	Landes fine sandy loam, bottom	.79	2.94	1,880	None to slight	1,880	....	....	....	....	....
305	Palestine loam	.28	1.04	668	None to slight	564	104	....	....	....	....
306	Allison silty clay loam, bottom	1.23	4.61	2,953	None to slight	2,953	....	....	....	....	....
307	Iona silt loam	1.38	5.17	3,310	None to slight	1,461	1,763	....	....	....	....
					Moderate	.....	86	....	....	....	....
308	Alford silt loam	2.03	7.60	4,862	None to slight	135	1,037	181	....	....	....
					Moderate	.....	29	1,900	353	285	....
					Severe	.....	....	345	278	319	....
309	Keytesville silt loam	.10	.37	236	None to slight	42	134	....	....	....	....
					Moderate	.....	....	30	15	....	....
					Severe	.....	....	15	....	....	....
331	Haymond silt loam, bottom	.29	1.06	681	None to slight	681	....	....	....	....	....
332	Billett sandy loam	.33	1.24	795	None to slight	555	240	....	....	....	....
333	Wakeland silt loam, bottom	1.59	5.96	3,812	None to slight	3,812	....	....	....	....	....
334	Birds silt loam, bottom	.11	.42	271	None to slight	271	....	....	....	....	....
382	Belknap silt loam, bottom	5.72	21.38	13,684	None to slight	13,684	....	....	....	....	....
	Gravel pit and borrow pit	.17	.65	414	....	.....	....	....	....	....	....
	Water	.98	3.68	2,358	....	.....	....	....	....	....	....
	Total	**100.00**	**374.00**	**239,360**	....	**133,406**	**54,637**	**29,654**	**14,371**	**3,739**	**781**
	Area of each erosion and slope group										
	Silty deposition	1.59	5.91	3,774	Silty deposition	3,774	....	....	....	....	....
	None to slight	78.92	295.15	188,908	None to slight	129,632	52,740	5,984	512	40	....
	Moderate	11.68	43.69	27,958	Moderate	.....	1,890	19,695	4,362	1,437	574
	Severe	6.66	24.92	15,948	Severe	.....	7	3,975	9,497	2,262	207

DESCRIPTION OF LAWRENCE COUNTY SOILS

On the following pages will be found a description of each soil type in Lawrence county, including general occurrence, formation, and profile characteristics. Thicknesses indicated for the surface horizons of the profiles are for areas that have not been seriously eroded. Also, the acidity and fertility levels given are in general for untreated soils. The types are given in numerical order, as they are also in Table 1, pages 7 to 9, which shows the area of each type in the county.

For use and management recommendations, turn first to the index on page 5. This will show the management group to which each mapping unit belongs, and the page on which that group is described. (It will also show the page where the soil type is described.)

Cisne silt loam (2)

Cisne silt loam is a brownish-gray upland soil developed under grass vegetation on slopes of less than 1½ percent. A few depressional areas are included with this type in Lawrence county, but their total acreage is small. This type occurs in association with Huey silt loam (120) and Hoyleton silt loam (3) in the western part of Lawrence county. The loess from which these soils have developed is less than 45 inches thick. Below the loess is weathered Illinoian till.

Soil profile. The surface soil is a brownish-gray, coarse silt loam about 10 inches thick. It is fairly low in organic matter and tends to pack and crust after rains. The subsurface is a light-gray silt loam 8 to 10 inches thick. Usually it has a platy structure and contains numerous brown iron concretions. The subsoil, which begins at a depth of 16 to 21 inches, is a gray to dark-gray, heavy silty clay loam or silty clay, mottled with brownish yellow. Its structural aggregates are angular and arranged in prismatic form. The subsoil is very slowly permeable to water. Below a depth of 30 to 35 inches the material contains less clay than does the subsoil and is more friable. Cisne is strongly acid and generally low in available phosphorus and potassium, especially where little or no soil treatment has been applied. (A profile of Cisne is shown in Fig. 2, page 6.)

Hoyleton silt loam (3)

Hoyleton silt loam is a brownish-gray upland soil found on slopes ranging from about 1 to 6 percent (Fig. 3). Native vegetation was grass, and parent ma-

Meanings of some technical terms. In the following pages of this report some technical terms have been used that may be unfamiliar to many readers. The terms most likely to need explanation are defined on pages 90 and 91. We suggest a study of this list and frequent reference to it.

An area of Hoyleton silt loam on gentle slopes in the foreground with Bluford and Blair silt loams on more rolling areas in the background. (Fig. 3)

terial was thin loess over weathered Illinoian till. Hoyleton occurs in the western part of the county in association with Huey silt loam (120), Cisne silt loam (2), and Richview silt loam (4).

Soil profile. The surface soil is a brownish-gray silt loam 8 to 11 inches thick. The subsurface is a grayish-yellow to pale-yellow silt loam, 7 to 10 inches thick, that usually has platy structure. Small reddish mottles may sometimes occur in the lower part of this horizon. The subsoil, which begins at a depth of 17 to 20 inches, is a yellowish-gray to gray heavy silty clay loam to silty clay. The upper 6 to 8 inches of this horizon is highly mottled with yellowish red; below this are mottles of brown and yellowish brown. The subsoil has prismatic structure and is very slowly permeable to water. Hoyleton is acid in reaction, and where it has been farmed for many years without soil treatment, it is low in organic matter and available phosphorus and potassium.

Richview silt loam (4)

Richview silt loam is an upland soil developed under grass vegetation. It occurs on ridge tops, with slopes ranging from 3 to 7 percent. This soil type is found in association with Hoyleton silt loam (3) in the western part of the county. In this area the soils developed from thin loess over weathered Illinoian till.

Soil profile. The surface soil is a brownish-gray, friable silt loam 7 to 9 inches thick. The subsurface is a brownish-yellow to pale-yellow silt loam about 8 inches thick. The upper 6 inches of the subsoil, beginning at a depth of about 15 inches, is a yellowish-brown silty clay loam with a few, small yellowish-red mottles. Just below this is the heaviest part of the subsoil — an 8- to 10-inch-thick layer of heavy silty clay loam with blocky structure. In color it is mixed yellowish brown and gray, highly mottled with yellowish red. Below depths of 30 to 35 inches the material is more friable and often contains some sand. If untreated, Richview is acid and generally low in organic matter, available phosphorus, and available potassium.

Blair silt loam (5)

Blair silt loam is a light-colored upland soil developed under forest vegetation from thin loess on Illinoian till. Slopes vary from 4 to about 12 percent. Blair is commonly associated with Bluford silt loam (13) and Ava silt loam (14).

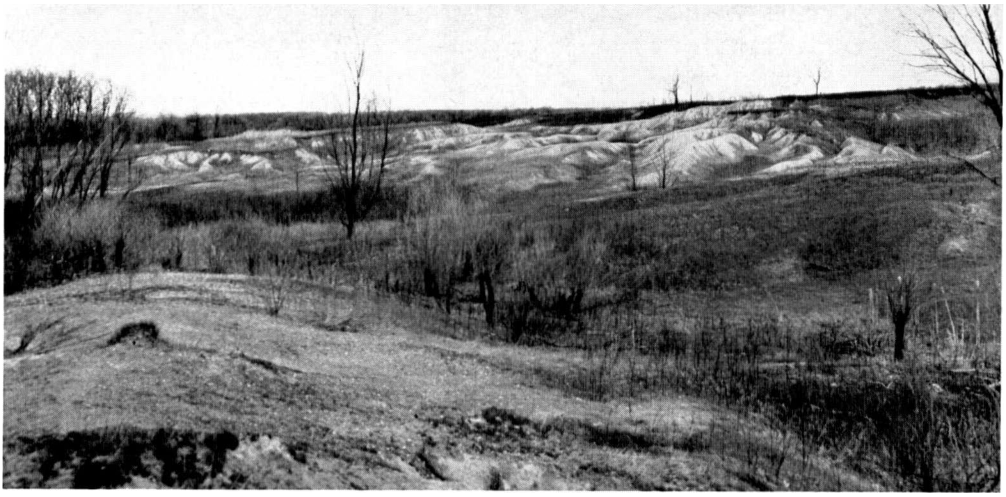
Soil profile. The loess from which the upper part of the profile was developed is generally less than 24 inches thick, so that much of the subsoil has formed from the underlying Illinoian glacial till.

The surface soil is a yellowish-gray silt loam 4 to 5 inches thick. The subsurface is a grayish-yellow silt loam, 6 to 8 inches thick, with platy structure. The subsoil, which begins at depths of about 10 to 13 inches, is a silty clay loam to clay loam with blocky structure. It is gray or yellowish gray mottled with yellowish brown. Below a depth of 24 inches, the subsoil usually contains some sand, thus showing the influence of the underlying till. This soil is very slowly permeable to water. It is acid, very low in available phosphorus, and low to medium in available potassium.

Hickory loam (8)

Hickory loam is a light-colored, upland soil developed under forest vegetation on slopes varying from 10 to 30 or more percent. It doesn't often occur by itself in Lawrence county, but it does occur extensively in a soil complex with Ava silt loam (shown as 8-14 on the soil map), with Hosmer silt loam (8-214), and with Alford silt loam (8-308). In Lawrence county, Hickory loam usually has had better underdrainage and is coarser-textured than in other counties farther west. The profile of Hickory is described below, and the soil complexes of which it is a part are described under separate headings.

Soil profile. Hickory loam has been formed by the weathering of Illinoian glacial till on slopes where practically all the loess deposits have been lost by



The surface soil has been eroded from this area of Hickory loam, exposing a yellowish-brown clay loam mottled with gray. (Fig. 4) erosion. Areas of Hickory still in trees have a brownish-gray silt loam or loam surface 3 or 4 inches thick. In unprotected areas this surface has been removed by erosion, leaving a yellowish-brown clay loam mottled with varying amounts of gray (Fig. 4). There is not much change for several feet in depth. Hickory is acid in reaction, low in available phosphorus, and low to medium in available potassium.

A few areas of Hickory loam in Lawrence county include small outcrops of shale or sandstone bedrock. These areas, for the most part, are near the breaks from upland into the Wabash and Embarrass river terraces or bottomlands.

Hickory loam-Ava silt loam, complex (8-14)

In areas marked as 8-14 on the soil map, Hickory loam and Ava silt loam are so intermingled that they could not be shown separately on the small-scale soil map. They are both light-colored, upland soils developed under forest vegetation. In the complex they are found on slopes ranging from 5 to 30 percent. Usually Ava occupies the upper one-fourth (in some areas the upper half) of a slope, and Hickory the lower portion.

These two soil types were mapped separately in some areas in Lawrence county and are described separately. See page 12 for a description of Hickory and page 14 for a description of Ava.

Hickory loam-Hosmer silt loam, complex (8-214)

The numbers 8-214 on the soil map indicate that Hickory loam and Hosmer silt loam could not be separated on the scale used in making the map. Both Hickory and Hosmer are light-colored, upland soils developed under forest vegetation. In the 8-214 complex they occur on slopes ranging from 7 to 30 percent. Usually Hosmer occupies the upper one-third or one-half of a slope, and Hickory, the remaining portion. In some areas Hosmer may occupy as much as two-thirds of a steep slope.

These two soil types were mapped separately in some areas in Lawrence county and are described separately. See page 12 for a description of Hickory and page 30 for a description of Hosmer.

Hickory loam-Alford silt loam, complex (8-308)

The numbers 8-308 on the soil map indicate that Hickory loam and Alford silt loam are too intermingled to be shown separately on a small-scale map. Both are light-colored, upland soils developed under forest vegetation. In the complex they occur on slopes ranging from 7 to 30 percent, with Alford usually occupying the upper half to three-fourths of a slope and Hickory occupying the remaining portion.

These two soil types were mapped separately in some areas in Lawrence county and are described separately. A description of Hickory is on page 12 and a description of Alford on page 36.

Wynoose silt loam (12)

Wynoose silt loam is a light-colored, upland soil that developed under forest vegetation from thin loess over leached Illinoian till. It occurs on slopes of less than 1½ percent. In many respects it is similar to Cisne silt loam (2). The surface soil of Wynoose, however, is thinner and somewhat lighter-colored, since it developed under forest vegetation, whereas Cisne developed under grass. Wynoose is associated with Bluford silt loam (13) and Ava silt loam (14).

Soil profile. The surface is a gray to light brownish-gray silt loam 6 to 8 inches thick. Numerous brown, rounded, iron concretions, often called "buckshot," are present in this layer as well as in the rest of the profile. The subsurface is a light-gray to nearly white silt loam with platy structure. This layer is 10 to 12 inches thick. The subsoil is a compact silty clay with prismatic structure. Ordinarily it extends from depths of about 18 inches to 35 or 40 inches. In color it is gray mottled with pale yellow and yellowish brown. It is very slowly permeable to water. Below the subsoil the material usually becomes more friable.

Wynoose is strongly acid, very low in available phosphorus, and low in available potassium.

Some chemical and physical data for a soil profile of Wynoose silt loam are given in Table 15, page 81.

Bluford silt loam (13)

Bluford silt loam is a light-colored soil developed under forest cover. It is similar in many respects to Hoyleton silt loam (3). But since Bluford developed under forest while Hoyleton developed under grass, the surface of the former is thinner and somewhat lighter in color. Bluford occurs on slopes of 1 to 4 percent on upland areas and was formed from thin loess over weathered Illinoian till. It is associated with Wynoose silt loam (12), Blair silt loam (5), and Ava silt loam (14).

Soil profile. The surface soil is a yellowish-gray to brownish-gray silt loam 6 to 8 inches thick. The subsurface is a yellowish-gray to pale-yellow silt loam with platy structure. The subsoil, beginning at depths of about 16 to 19 inches, is a yellowish-gray silty clay loam to silty clay, mottled with gray and yellowish brown. Below a depth of 35 inches the material usually is more friable and frequently contains some sand. The subsoil has prismatic structure and is very slowly permeable to water. Bluford is strongly acid, very low in available phosphorus, and low in available potassium.

Ava silt loam (14)

Ava silt loam is a light-colored upland soil formed from thin loess over leached Illinoian till. It is similar in many respects to Richview silt loam (4), but differs chiefly in having a thinner and somewhat lighter-colored surface soil. This is due to the fact that Ava developed under forest vegetation, while Richview developed under grass. Ava occurs on slopes ranging from 2 to 12 percent (Fig. 5), and is associated with Bluford silt loam (13) and Hickory loam (8).

Besides being shown by itself on the Lawrence county soil map, Ava is also indicated as a member of the Hickory-Ava soil complex in the areas numbered 8-14 (page 13).

Soil profile. The surface is a friable grayish-yellow to brownish-gray silt loam, 5 to 7 inches thick, and the subsurface is a brownish-yellow silt loam. The subsoil begins at depths of 14 to 17 inches. The upper 6 to 8 inches is yellowish brown. Then there is a transitional zone, 3 or 4 inches thick, in which

Permanent pasture on some of the more sloping areas of Ava silt loam. (Fig. 5)

the structural aggregates are thickly coated with gray silty material. The lower part of the subsoil is yellowish brown, highly mottled with gray and pale yellow. The subsoil is a very slowly permeable silty clay loam with nutlike structure. Below the subsoil the material is frequently somewhat sandy or is a silt loam. Ava is acid, very low in available phosphorus, and about medium in available potassium.

Some chemical and physical data for a soil profile of Ava silt loam are given in Table 15, page 81.

Herrick silt loam (46)

Herrick silt loam is a dark-colored soil developed under grass vegetation on slopes of less than 1½ percent. In Lawrence county it occurs on the high, loess-covered terrace in the Pinkstaff area (page 82) in association with Virden silty clay loam (50) and Breese silt loam (170).

Soil profile. The surface soil is a brown to grayish-brown silt loam 9 to 12 inches thick. The subsurface is a brownish-gray to grayish-brown silt loam and extends to depths of 15 or 18 inches. The subsoil, immediately below the subsurface, is a dark-gray silty clay loam mottled with light gray and yellow. It has blocky structure and is moderately slowly permeable to water but can be tile-drained. Herrick is slightly to medium acid in reaction in the upper part of the profile and becomes calcareous below a depth of 50 inches. It is medium to low in available phosphorus and about medium in available potassium.

Virden silty clay loam (50)

Virden silty clay loam is a dark-colored soil developed from loess under grass vegetation and poor natural drainage. It occurs on nearly level to slightly depressional areas on slopes of less than ½ percent, and in Lawrence county is found on the high, loess-covered terrace in the Pinkstaff area (page 82) as well as on the upland. Some areas of this soil type have received several inches of light-colored silty sediments from higher land. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface horizon is a very dark-brown to black silty clay loam that extends to a depth of 10 to 14 inches. The subsurface is a grayish-brown silty clay loam. Beginning at depths of 18 to 20 inches, the subsoil is a dark-gray silty clay loam mottled with yellowish brown. The subsoil has blocky structure and is moderately slowly permeable to water, but can be tile-drained. Virden is slightly acid to neutral in reaction, low to medium in available phosphorus, and medium to high in available potassium.

Bloomfield fine sand (53)

In Lawrence county, Bloomfield fine sand occurs on both upland and terrace positions. Slopes vary from 1 to about 12 percent. It has developed under the influence of hardwood forest from wind-deposited or wind-reworked sandy parent material. Some areas included with this soil type are predominantly medium sand instead of fine sand, and in a few places, the surface horizon is somewhat thicker and slightly darker than is normal for this soil type.

Soil profile. The surface is normally a yellowish-brown fine sand to loamy fine sand 4 to 6 inches thick. The subsurface is a brownish-yellow fine sand. There is very little clay accumulation in the subsoil. However, beginning at depths of about 45 to 50 inches, there are reddish-brown bands representing accumulations of iron and slight amounts of clay. Below a depth of 8 feet the material often is calcareous. Bloomfield is medium to slightly acid, about medium in available phosphorus, and generally low in available potassium.

Beaucoup silty clay loam, bottom (70)

Beaucoup silty clay loam is a moderately dark-colored bottomland soil found on the flood plains of the Embarrass and Wabash rivers (Fig. 6). It has developed under poor to very poor drainage conditions. Beaucoup is frequently associated with Darwin clay (71) and Petrolia silty clay loam (288). Extremely wet areas of this soil type are indicated by swamp symbols on the soil map. Some areas have had several inches of light-colored, silty sediment washed onto them from surrounding higher land. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Alfalfa and corn do well on Beaucoup silty clay loam, bottom, after it has been adequately drained and fertilized. (Fig. 6)

Soil profile. The surface soil, which is 8 to 12 inches thick, is a grayish-brown to brownish-gray silty clay loam with some blocky structure. Below the surface the material is a gray to dark-gray silty clay loam mottled with yellowish brown. It has some blocky structural development and is slowly permeable to water. Beaucoup is slightly acid to neutral in reaction, medium in available phosphorus, and medium to high in available potassium.

Darwin clay, bottom (71)

Darwin clay, bottom, occurs extensively on the Embarrass and Wabash river flood plains. It is also found in some of the bottomlands in association with such soils as Bonpas silty clay loam (126) and Patton silty clay loam (142), which occur on terraces formed by slack-water deposits. Darwin has developed under very poor natural drainage. Extremely wet areas of this soil type are indicated by swamp symbols on the soil map. Also some areas, indicated by a plus sign after the slope-group letter on the soil map, have received several inches of light-colored silty sediments from surrounding higher land.

Soil profile. The surface soil is a plastic clay to silty clay, 10 to 15 inches thick. It is grayish brown, often tinged with olive. This olive tinge becomes more pronounced in the subsurface material, which has less organic matter than the surface. Throughout the profile the texture is a silty clay or clay, with some gravel occurring below depths of 35 or 40 inches in a few areas. Some angular blocky structural development is evident throughout the upper 30 inches of the profile.

This soil type is very slowly permeable to water, slightly acid to neutral in reaction, and about medium in both available phosphorus and available potassium. Some chemical and physical data for a soil profile of Darwin clay, bottom, are given in Table 18, page 86.

Sharon loam occupies the small bottom in left part of picture. Hickory loam (8) occurs on the 25-percent slope at right. (Fig. 7)

Sharon loam, bottom (72)

Sharon loam is a light-colored soil developed from silty sediments in small bottoms (Fig. 7). It has a thicker surface soil and is better drained than either Belknap silt loam (382) or Bonnie silt loam (108), two soils with which it is commonly associated.

Soil profile. The surface is a brownish-gray to light-brown silt loam or loam, usually more than 24 inches thick. Below the surface layer the soil may be pale brown, but usually some gray mottles are present, especially below 35 inches. In texture it is a silt loam with some sand present. This soil, where untreated, is medium acid, low in available phosphorus, and medium to low in available potassium.

Drury silt loam (75)

Drury silt loam is a light-colored terrace soil found in colluvial positions where it has received "wash" from adjacent bluffs. It occurs on slopes ranging from 1 to 4 percent and probably was forested. However, some areas included with this type in Lawrence county are rather dark-colored and show the influence of grass vegetation.

Soil profile. The surface soil is a friable, brownish-gray to dark yellowish-brown silt loam 8 to 10 inches thick. The subsurface is light yellowish-brown silt loam. No true subsoil has developed in this soil because of its youthfulness, but below depths of 18 to 22 inches the color becomes brownish yellow. The texture remains a silt loam. Drury is neutral to slightly acid in reaction, medium in available phosphorus, and about medium in available potassium.

Wabash silty clay, bottom (83)

Wabash silty clay is a dark-colored bottomland soil found in sloughs and old, partially filled channels in the flood plains of the Embarrass and Wabash rivers. It has been formed from fine-textured sediments deposited by slack water and from large accumulations of organic matter. Swampy areas of this soil type are indicated on the soil map by swamp symbols. Also, some areas have received a few inches of light-colored silty sediments from higher land and are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a black, plastic silty clay or clay about 15 inches thick. Below this horizon the material is a dark-gray silty clay or clay. Faint mottles of pale orange and rusty brown occur below a depth of 24 inches. Some gravel is present below depths of 30 or 35 inches in some areas in Lawrence county. This soil has some blocky structure. It is slowly permeable to water and has slow underdrainage. Wabash is slightly acid to neutral in reaction, medium to high in available phosphorus, and high in available potassium.

Hagener loamy sand (88)

Hagener loamy sand is a moderately dark-colored terrace soil developed under grass vegetation on slopes ranging from 1 to 7 percent.

Some areas included with this soil type in Lawrence county have a sandy loam surface instead of the normal loamy sand. Also, some areas have more clay accumulation beneath the subsurface and therefore have slightly greater water-holding capacity than is normal for Hagener.

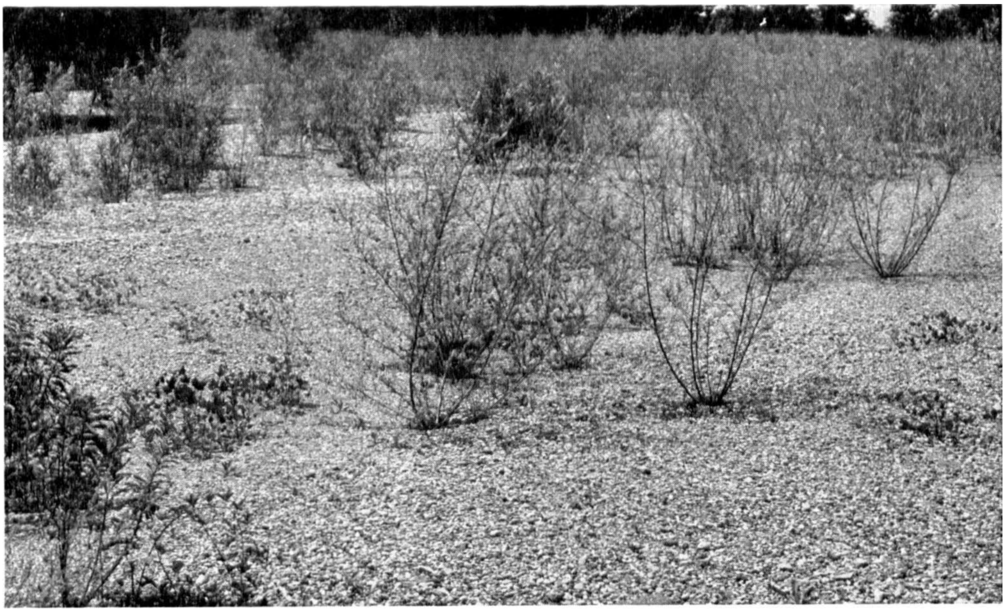
Soil profile. The surface is a brown loamy sand 14 to 22 inches thick. The subsurface is also a loamy sand, but is not so dark as the surface. It extends to depths of 25 to 30 inches. No true subsoil has developed in this type, there being very little clay accumulation beneath the subsurface. For several feet below the subsurface the material is loose brownish-yellow sand. Hagener is moderately acid, and low in available phosphorus and available potassium.

Some chemical and physical data for a soil profile of Hagener loamy sand are given in Table 16, page 83.

Perks sand, bottom (92)

Perks sand is a light-colored bottomland soil made up of recently deposited material. A few areas occur in the Embarrass river bottom, but most of it is found along the Wabash river. It occurs on slopes ranging from ½ to 4 percent.

Soil profile. Perks sand has been deposited so recently that no soil development has yet taken place. It is a yellowish-brown to yellowish-gray sand mixed with a small amount of fine silty material. Some recently deposited river gravel is included with Perks sand on the soil map of Lawrence county (Fig. 8). The major area of gravel is about 5 miles south of Russellville next to the Wabash river, where the levee broke during the flood of 1950. Both Perks sand and the gravel included with this soil type are calcareous. The gravelly areas are generally not suited for farming; and the sand areas are usually too drouthy for good crop production even though they are fairly high in available phosphorus and available potassium.



The flood of 1950 left this thick bed of sand and gravel near a broken levee on the Wabash river. Such deposits are included with Perks sand on the soil map. (Fig. 8)

Sawmill silty clay loam, bottom (107)

Sawmill silty clay loam is a dark-colored soil found on the flood plains of the Embarrass and Wabash rivers and in old channels or sloughs that traverse the terrace area east of Lawrenceville. Some areas in Lawrence county have received a few inches of light-colored silty sediments from higher land. This condition is indicated on the soil map by a plus sign (+) after the slope-group letter. Sawmill has developed under poor natural drainage.

Soil profile. The surface is a black silty clay loam about 15 inches thick. Below this layer the material becomes more gray in color, with rusty, brownish mottles often occurring below a depth of 24 inches. The material is usually a silty clay loam throughout the profile, although in a few areas in Lawrence county some gravel is present below 30 inches. This soil has some blocky structure. Although it is moderately slowly permeable to water, it can be drained with tile. It is slightly acid to neutral in reaction, medium to high in available phosphorus, and high in available potassium.

Bonnie silt loam, bottom (108)

Bonnie silt loam is a gray bottomland soil which occurs on the flood plains of small streams in Lawrence county. It has a thinner surface soil and poorer natural drainage than Belknap silt loam (382) and Sharon silt loam (72), two soils with which it is associated.

Soil profile. The surface varies from about 2 to 8 inches in thickness and is a brownish-gray to dark-gray silt loam. Beneath this horizon the material becomes quite gray — in some cases nearly white — in color. It is a silt loam with silty clay or clay layers occurring below depths of 60 to 80 inches. The gray silty layer below the surface is very dense, nearly structureless, and only slowly permeable to water. Bonnie, where untreated, is medium to strongly acid, low in available phosphorus, and low to medium in available potassium.

Racoon silt loam (109)

Racoon silt loam is a light-colored terrace soil found on colluvial slopes of less than 2-percent gradient. Most areas of this soil type have received "wash" from adjacent, steep, upland soils such as Hickory loam (8) or Ava silt loam (14). The terrace areas on which Racoon occurs are frequently low-lying and grade very gradually into bottomland soils such as Bonnie silt loam (108) and Belknap silt loam (382). Racoon has formed under forest vegetation and poor to very poor natural drainage.

Soil profile. The surface soil is a gray to light brownish-gray silt loam 6 to 8 inches thick. The subsurface is a light-gray silt loam that has platy structure and is 17 to 22 inches thick. The subsoil, beginning at depths of about 24 to 30 inches, is gray, mottled with yellowish brown. Although variable in texture, it is usually a silty clay loam or silty clay with some prismatic structure. Below depths of 40 to 45 inches the material often becomes more friable. Racoon is strongly acid, very low in available phosphorus, and low in available potassium.

Whitson silt loam (116)

Whitson silt loam is a light-colored soil found on nearly level areas (slopes of less than 1 percent) on the high loess-covered terrace in the Pinkstaff area. Native vegetation was forest. Whitson is associated with Iona (307) and Alford (308) silt loams but has developed under poorer natural drainage than either of these two soils.

Soil profile. The surface is a gray to light brownish-gray silt loam 6 to 8 inches thick. The subsurface, which is 10 to 12 inches thick, is a light-gray silt loam with platy structure. Beginning at depths of 16 to 18 inches, the subsoil is a yellowish-gray silty clay loam mottled with light gray and yellowish brown. It usually has angular blocky structure. Calcareous loess occurs below depths of 35 to 45 inches.

Whitson is medium to slightly acid in reaction, low in available phosphorus, and about medium in available potassium.

Some chemical and physical data for a soil profile of Whitson silt loam are given in Table 13, page 79.

Huey silt loam (120)

Huey silt loam is a light-colored upland soil. It is usually associated with Cisne and Hoyleton silt loams (Soil Types 2 and 3), but is also sometimes found in association with Wynoose (12) and Bluford (13) silt loams. Individual areas of this soil type are usually small and are known locally as "slick spots," "scald spots," "scalds," "hardpans," "deer licks," or "buffalo wallows." Most areas of Huey silt loam in Lawrence county were formed under the influence of prairie grass and probably weeds. However, some developed under forest vegetation. A number of areas are depressional while others have slopes ranging up to 3 or 4 percent. The more sloping areas are usually along or near the "head" of shallow drainageways. Many areas were included with adjacent soil types on the map because they were too small to be shown.

Soil profile. The surface soil is a gray to light-gray silt loam 4 to 6 inches thick. The subsurface is a very light-gray or nearly white silt loam with platy structure. It may be very thin or as much as 6 to 10 inches thick. Small black or brown iron-manganese concretions are present in both the surface and subsurface. In uneroded areas of Huey in Lawrence county, the depth to subsoil varies from 7 to 14 inches. The subsoil is a compact silty clay loam to clay with prismatic structure. Usually it is a dull gray, mottled with brown and yellowish brown, but in a few areas the color is a rather uniform light brown or "chocolate" brown. Limestone concretions are common. The subsoil is nearly impervious to water. When wet, it is very sticky and easily puddled; when dry, it is very hard.

The unfavorable physical nature of the subsoil is due largely to an accumulation of alkali salts, mainly of sodium. During periods of drouth a white powdery coating of these alkali salts on the soil particles can often be seen, especially where the subsoil has been exposed by erosion.

The surface of Huey is usually acid, low in available phosphorus and available potassium, and also low in organic-matter content. The reaction of the subsoil, however, is usually alkaline because of excess sodium salts.

Selma loam (125)

Selma loam is a dark-colored terrace soil developed from mixed alluvial sediments under prairie and swamp-grass vegetation. It occurs on slopes of less than 1½ percent in association with Cowling fine sandy loam (174) and various other terrace soils.

A few areas of this type in Lawrence county are depressional and very wet. This condition has been indicated on the soil map by swamp symbols. Other areas have received several inches of light-colored sediments from higher land. This condition is indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface is a black to dark grayish-brown heavy loam or sandy clay loam about 15 inches thick. The subsurface is a grayish-brown to very dark-gray loam or clay loam about 8 inches thick, and the subsoil is a gray clay loam mottled with yellowish brown. Below 35 or 40 inches a grayish sandy loam or sand occurs. Selma is slightly acid to neutral in reaction, low to medium in available phosphorus, and medium to high in available potassium.

Bonpas silty clay loam (126)

Bonpas silty clay loam is a dark-colored terrace soil derived from fine-textured sediments on nearly level areas. It has developed under prairie and swamp-grass vegetation and is associated with Patton silty clay loam (142) and Marissa silt loam (176). Very wet areas of this soil type are indicated on the soil map by swamp symbols. Areas that have received light-colored sediments from higher land are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a black to dark grayish-brown silty clay loam 12 to 14 inches thick. The subsurface is a dark grayish-brown silty clay loam about 6 or 8 inches thick. The subsoil, which begins at depths of about 18 to 22 inches, is a dark-gray silty clay loam mottled with pale yellow and yellowish brown. Ordinarily the material remains a silty clay loam for several feet below a depth of 40 inches. Bonpas has well-developed blocky structure. Although it is moderately slowly permeable to water, it can be drained with tile. It is slightly acid to neutral in reaction, about medium in available phosphorus, and high in available potassium.

Starks silt loam (132)

Starks silt loam is associated with Camden silt loam (134) and Sexton silt loam (208). It is a light-colored terrace soil found on slopes varying between ½ and 4 percent. It has developed under forest vegetation from silty, water-deposited sediments. A few areas in Lawrence county have received light-colored silty sediments from higher land and thus seem to have thicker surface soils than normal. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a yellowish-gray to light brownish-gray silt loam 5 to 8 inches thick. The subsurface is a yellowish-gray silt loam, often having platy structure. The subsoil, which begins at depths of 16 to 18 inches, is a gray to yellowish-gray silty clay loam mottled with yellowish brown. It has blocky structure and can be tile-drained.

Generally, sand occurs below 40 inches but in some places a silty clay loam layer extends several feet below 40 inches.

Starks is medium to strongly acid, low in available phosphorus, and medium in available potassium.

Camden silt loam (134)

Camden silt loam is a light-colored, well-drained terrace soil developed from silty sediments under forest vegetation. It occurs on slopes ranging from 1 to 12 percent, and is associated with Starks (132) and Sexton (208) silt loams.

Soil profile. The surface is a yellowish-gray to brownish-gray silt loam 6 to 8 inches thick. The subsurface is a yellowish-gray silt loam. The subsoil begins at depths of 14 to 16 inches and is a brownish-yellow silty clay loam with rounded nutlike structure. Sandy material usually occurs below 40 inches, although in some areas in Lawrence county the depth to sandy material is more than 60 inches. Camden is medium to slightly acid, low in available phosphorus, and about medium in available potassium.

On page 83 are some chemical and physical data for a profile of Camden.

Patton silty clay loam (142)

Patton silty clay loam is a moderately dark-colored terrace soil developed under mixed forest and swamp-grass vegetation from fine-textured sediments. Slopes are less than 1 percent. Patton is associated with Bonpas silty clay loam (126), Marissa silt loam (176), and McGary silt loam (173). Some areas in Lawrence county have received several inches of light-colored silty sediments and these areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface horizon is a grayish-brown to brownish-gray silty clay loam 8 to 12 inches thick. The subsurface is a dark-gray to olive-gray silty clay loam. The subsoil, beginning at depths of about 18 or 20 inches, is a gray or light olive-gray silty clay loam mottled with yellowish-brown. The silty clay loam material usually extends down for several feet below a depth of 40 inches. Patton has blocky structure. Although it is moderately slowly permeable to water, it can be drained with tile. It is slightly acid to neutral in reaction, medium in available phosphorus, and high in available potassium.

Proctor silt loam (148)

Proctor silt loam is a well-drained, dark-colored terrace soil developed from medium-textured sediments. Native vegetation was grass. Proctor occurs on slopes of less than 1 percent, in association with Carmi loam (285), Carmi sandy loam (286), and Omaha loam (289). Some areas of Proctor are slightly depressional, but because of a gravelly substratum, drainage is not a problem.

Soil profile. The surface soil is a brown to dark-brown silt loam 10 to 12 inches thick. The subsurface is a brown to light-brown silt loam, and the subsoil, beginning at depths of 16 to 18 inches, is a yellowish-brown silty clay loam with a small amount of sand or small gravel mixed with it. Gravel commonly is found below a depth of 40 inches.

Proctor is medium to slightly acid, low to medium in available phosphorus, and high in available potassium.

A gravel pit in an area of Stockland loam. Considerable commercial use is made of the gravel underlying Stockland and associated soils. (Fig. 9)

Stockland loam (155)

Stockland loam is a moderately dark-colored terrace soil developed from mixed alluvial sediments under a grass vegetation. It occurs in association with Carmi loam (285) and Carmi sandy loam (286). Stockland may be found on slopes varying from 1 to 12 percent, but usually it is found on the steeper slopes where the terraces break into bottomland.

Soil profile. Profile development in this soil has been slight. The surface is a dark-brown to brown loamy gravel or gravelly loam 3 to 8 inches thick. With depth the color becomes lighter and the material becomes more gravelly (Fig. 9). Many areas have been eroded severely and are now quite gravelly on the surface. Stockland is drouthy, and because of the gravel, it is often difficult to farm. It is slightly acid in reaction, medium to high in available phosphorus, and high in available potassium.

Stoy silt loam (164)

Stoy silt loam occurs in association with Hosmer silt loam (214) and Weir silt loam (165). It is a light-colored, loess-derived, upland soil formed under the influence of forest vegetation on slopes varying from ½ to 4 percent.

Soil profile. The surface soil is a light brownish-gray to yellowish-gray silt loam about 6 inches thick. The subsurface is a yellowish-gray silt loam with platy structure. The subsoil begins at about 16 to 18 inches. It is a yellowish-gray silty clay loam mottled throughout with gray and yellowish brown, and is moderately compact and plastic. It has some blocky as well as prismatic structure and is slowly permeable to water.

Stoy is medium acid in reaction, low in available phosphorus, and medium in available potassium.

Weir silt loam (165)

Weir silt loam is a light-colored, upland soil developed under forest vegetation from loess, on slopes of less than 1½ percent. It is associated with Hosmer (214) and Stoy (164) silt loams but has developed under poorer natural drainage conditions than either of these two soils.

Soil profile. The surface soil is a light brownish-gray to gray silt loam 6 to 8 inches thick. The subsurface is a light-gray silt loam with platy structure, and the subsoil is a gray silty clay loam mottled with pale yellow and "rusty" brown. The subsoil ordinarily begins at a depth of about 18 inches and extends to about 35 inches. It has prismatic structure and is very slowly permeable to water.

Weir is medium to strongly acid in reaction, low in available phosphorus, and low to medium in available potassium.

Some chemical and physical data for a soil profile of Weir silt loam are given in Table 14, page 80.

Lukin silt loam (167)

Lukin silt loam is a gently sloping soil (slopes range from 1½ to 4 percent) developed from thin loess and colluvial "wash" from nearby higher land. It occurs on upland and on colluvial terraces, usually in positions where it receives sediment eroded from higher land. It has been formed under grass or mixed grass and forest vegetation. It is associated with Chauncey (287), Bluford (13), and Ava (14) silt loams.

Soil profile. The surface is a brownish-gray silt loam 9 to 12 inches thick. The subsurface is a yellowish-gray or pale-yellow silt loam about 15 inches thick. The subsoil, which begins at depths of 24 to 28 inches, is a yellowish-gray to gray silty clay loam in the upper part and silty clay or heavy silty clay loam in the lower part. It is mottled throughout with yellowish brown.

Lukin is acid, low in available phosphorus, and about medium in available potassium.

Flora silt loam (168)

Flora silt loam is a light-colored terrace soil developed from loess under forest vegetation on terraces of Illinoian age. It occurs on slopes of less than 1½ percent in association with Freeburg silt loam (169). Except for its terrace position, it is similar in many respects to Wynoose silt loam (12), which occurs on upland flats.

Soil profile. The surface soil is a gray silt loam 6 to 8 inches thick. The subsurface is a light-gray silt loam with platy structure. Beginning at depths of about 18 to 21 inches, the subsoil is a gray to dark-gray heavy silty clay loam or silty clay mottled with yellowish brown. It has prismatic structure and is compact, plastic, and very slowly permeable to water. At depths of 35 or 40 inches a highly weathered, pebbly clay commonly occurs, which may sometimes be water-reworked Illinoian till.

Flora is acid, low in available phosphorus, and low in available potassium.

Freeburg silt loam (169)

Freeburg silt loam is a light-colored terrace soil developed from loess under forest vegetation. Slopes range from 1 to 7 percent. Freeburg is associated with Flora silt loam (168). The major areas of these two soils in Lawrence county are in the vicinity of Sumner. Except for its terrace position, this soil is similar in many respects to Bluford silt loam (13) which occurs on the surrounding upland.

Soil profile. The surface is a yellowish-gray to brownish-gray silt loam 6 to 8 inches thick. The subsurface is a yellowish-gray silt loam with platy structure. The subsoil, which begins at depths of about 16 to 18 inches, is a yellowish-gray, heavy silty clay loam mottled with gray and yellowish brown. This mottling is less distinct in the more sloping areas than in the nearly level areas.

Freeburg is acid in reaction and low in both available phosphorus and available potassium.

Breese silt loam (170)

Breese silt loam is a moderately dark-colored soil developed from loess on slopes ranging between ½ and 3 percent. While this soil was forested at the time of settlement, the tree growth had not been there long enough to entirely change soil features left by an earlier grass vegetation. Breese silt loam is intermediate in character between Herrick silt loam (46) and Whitson silt loam (116).

In Lawrence county, Breese silt loam occurs on high loess-covered terraces as well as on upland. Its most extensive occurrence on terrace positions is in the vicinity of Pinkstaff. Some of the B (1½ to 4 percent) slope areas included with this soil type in Lawrence county have developed under better natural drainage conditions than is normal for Breese.

Soil profile. The surface soil is a brownish-gray silt loam 6 to 8 inches thick. The subsurface is a gray silt loam about 10 inches thick. Beginning at depths of 16 to 19 inches, the subsoil is a dark-gray silty clay loam, mottled with yellowish brown. Many dark organic coatings are present on the blocky structural aggregates of the subsoil. Breese is slightly to medium acid in reaction and often becomes calcareous below a depth of 50 inches. It is low in available phosphorus and about medium in available potassium.

McGary silt loam (173)

McGary silt loam is a light-colored terrace soil developed from fine-textured sediments under forest vegetation. Slopes range from ½ to 7 percent. McGary is associated with Marissa silt loam (176), Patton silty clay loam (142), and Bonpas silty clay loam (126).

Soil profile. The surface soil is a yellowish-gray to brownish-gray silt loam 4 to 6 inches thick. The subsurface is a light-gray to pale yellowish-gray silt loam with platy structure. The subsoil, which begins at depths of 10 to 15 inches, is a compact, plastic, heavy silty clay loam or silty clay. In color it is gray to olive-gray mixed with some yellowish brown. The subsoil has blocky structure and is very slowly permeable to water. On the steeper slopes the subsoil is usually more yellowish brown and somewhat better drained than on the more level areas.

McGary is low in available phosphorus and medium to high in available potassium. The surface and subsurface are medium acid in reaction whereas carbonates are usually present in the subsoil below depths of 24 to 30 inches.

Cowling fine sandy loam (174)

Cowling fine sandy loam is a light-colored terrace soil developed from sandy sediments under forest vegetation. Slopes vary from 1 to 7 percent. Cowling is associated with Ruark fine sandy loam (178) and Unity sandy loam (175).

Soil profile. The surface soil is a yellowish-gray to light brownish-gray fine sandy loam 6 to 8 inches thick. The subsurface is a yellowish-gray fine sandy loam. The subsoil is variable in texture and thickness but most commonly it begins at depths of 17 to 23 inches and is a yellowish-gray fine sandy clay loam to clay loam mottled with pale yellow and yellowish brown. Water-laid mixed sediments, predominantly sandy, occur below 40 inches. Cowling is medium to strongly acid and low in available phosphorus and available potassium.

Unity sandy loam (175)

Unity sandy loam is a light-colored terrace soil developed from sandy sediments under forest vegetation on slopes ranging from 1 to 12 percent. It is associated with Cowling (174) and Ruark (178) fine sandy loams and Billet sandy loam (332).

Soil profile. The surface is a grayish-yellow to brownish-yellow sandy loam to fine sandy loam 6 to 8 inches thick. The subsurface is a light-brown to yellowish-brown sandy loam 8 to 14 inches thick. The subsoil is variable in texture and thickness but ordinarily it begins at depths of 14 to 22 inches and is a reddish-yellow or brownish-yellow loam to sandy clay loam. Loose sand, which occurs below depths of 35 or 40 inches, causes this soil to be somewhat drouthy. It is medium acid and low in available phosphorus and available potassium.

Marissa silt loam (176)

Marissa silt loam is a moderately dark-colored terrace soil developed under mixed vegetation. This soil was forested at the time of settlement, but the trees had not been growing long enough to entirely change soil features imparted by an earlier grass vegetation. Marissa occurs on slopes of less than 1½ percent (Fig. 10) in association with McGary silt loam (173) Patton silty clay loam (142), and Bonpas silty clay loam (126). A few areas of this soil type have re-

Pasture in foreground is on Marissa silt loam. Wooded area next to pasture is on McGary silt loam (173), which often occurs in association with Marissa. (Fig. 10)

ceived several inches of light-colored silty sediments from higher land and are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a dark brownish-gray silt loam about 8 or 10 inches thick. The subsurface is dark-gray to gray silt loam 6 to 8 inches thick. The subsoil, ordinarily extending from depths of about 16 to 35 inches, is a gray or olive-gray silty clay loam mottled with yellowish brown. Usually heavy silty clay loam or silty clay material occurs below 35 inches, but sometimes sandy layers are present at that depth.

Marissa is medium to slightly acid, low in available phosphorus, and medium to low in available potassium.

Ruark fine sandy loam (178)

Ruark fine sandy loam is a light-colored terrace soil developed from sandy sediments under forest vegetation on slopes of less than 1 percent. It is associated with Cowling fine sandy loam (174) and Unity sandy loam (175). The few areas of this soil type on which several inches of light-colored silty sediments have been deposited are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a gray fine sandy loam 6 to 7 inches thick. The subsurface is a light-gray fine sandy loam, and the subsoil, beginning at depths of about 18 to 24 inches, is a gray to yellowish-gray loam to fine sandy clay loam mottled with pale yellow and yellowish brown. Mixed sandy and silty water-laid sediments occur below a depth of 40 inches. Small areas occur in this soil type that do not have the sandy clay loam subsoil described above. Instead, a fine sandy loam layer occurs in its place. Ruark is medium to strongly acid and low in available phosphorus and available potassium.

Roby fine sandy loam (184)

Roby fine sandy loam developed from a mixture of wind-deposited silt (loess) and fine sand under forest vegetation. It occurs on both upland and high terrace positions in Lawrence county. Slopes ordinarily vary from ½ to 4 percent, although a few depressional, very poorly drained areas are included with Roby on the soil map.

Soil profile. The surface is a yellowish-gray to brownish-gray fine sandy loam 5 to 7 inches thick. The subsurface is a yellowish-gray fine sandy loam. Dark-brown or black iron concretions are present in this horizon as well as in the subsoil, which begins at depths of 16 to 22 inches. The subsoil is somewhat variable in texture but usually is a fine sandy clay loam to sandy clay and is yellowish gray mottled with "rusty" brown. Below depths of 35 or 40 inches the material is a sandy loam or sand. Roby is medium acid and low in available phosphorus and potassium.

Kincaid fine sandy loam (186)

Kincaid fine sandy loam developed from a mixture of wind-deposited silt (loess) and fine sand under forest vegetation. It occurs in both upland and high terrace positions in Lawrence county, on slopes ranging from 1 to 30 percent. Kincaid is associated with Roby fine sandy loam (184).

Soil profile. The surface soil is a brownish-yellow fine sandy loam 5 to 7 inches thick. The subsurface is a light-brown fine sandy loam 10 to 15 inches thick. The subsoil, although variable in texture and thickness, usually begins at depths ranging from 15 to 22 inches and is a brownish-yellow to reddish-yellow fine sandy clay loam. In small scattered areas, particularly on the steeper slopes, this layer is absent. Sandy loam or sandy material occurs below 35 or 40 inches.

Kincaid is medium acid and low in available phosphorus and potassium.

Milroy sandy loam (187)

Milroy sandy loam is a moderately dark to light-colored terrace soil developed from mixed sandy and silty sediments on slopes of less than 1½ percent. Many areas are slightly depressional and probably were influenced by water-loving species of both trees and grasses.

Some areas included with this soil type in Lawrence county have a loam surface texture instead of the sandy loam described below. A few areas have had several inches of light-colored silty material deposited on them and are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is normally a brownish-gray or dark-gray sandy loam 6 to 8 inches thick. The subsurface is a gray sandy loam 10 to 15 inches thick and the subsoil usually is a gray clay loam or sandy clay mottled with "rusty" brown. The amount of clay accumulated in the subsoil and the depth to the subsoil are quite variable in this soil type. Gravel or sand, or both, frequently occur below depths of 30 to 40 inches.

Milroy is medium to strongly acid in reaction, low in available phosphorus, and low in available potassium.

Orio sandy loam (200)

Orio sandy loam is a dark-colored terrace soil developed from mixed sediments on nearly level or slightly depressional areas. The dominant native vegetation probably was swamp grass although, no doubt, water-loving species of trees were also present. Areas of this type that have not been adequately drained and are still very wet are indicated by swamp symbols on the soil map.

Soil profile. The surface soil is a dark grayish-brown sandy loam 10 to 14 inches thick. The subsurface is a gray to dark-gray sandy loam about 8 inches thick. The depth to subsoil and the amount of clay accumulation in the subsoil are variable. Ordinarily it begins at depths of about 18 to 21 inches and is a dark-gray clay loam or sandy clay mottled with brownish yellow.

Orio is medium acid, low in available phosphorus, and low in available potassium.

Sexton silt loam (208)

Sexton silt loam is a light-colored terrace soil developed from silty sediments under forest vegetation on nearly level to slightly depressional areas. Slopes seldom exceed 1 percent. Very wet, ponded areas are indicated by swamp symbols on the soil map.

Sexton is associated with Starks silt loam (132) and Camden silt loam (134). Several inches of light-colored silty sediment have been deposited in a few areas. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a gray to light brownish-gray silt loam 6 to 8 inches thick. In the few places where it has received deposits of silty sediment, it may appear to be thicker. The subsurface, 10 to 14 inches thick, is a light-gray silt loam with platy structure. The subsoil, beginning at depths of about 16 to 22 inches, is a gray silty clay loam mottled with brownish yellow. It has blocky to prismatic structure. Below 40 inches sand usually occurs, although sometimes a heavy silty clay loam layer is present instead of the sand.

Sexton is medium to strongly acid, low in available phosphorus, and low to medium in available potassium.

Hosmer silt loam (214)

Hosmer silt loam is a light-colored upland soil developed from loess under forest vegetation on slopes ranging from 2 to 18 percent. It is associated with Stoy (164) and Weir (165) silt loams.

Besides being shown by itself on the Lawrence county soil map, it is also indicated as a member of the Hickory-Hosmer soil complex in the areas numbered 8-214 (page 13).

Soil profile. The surface is a brownish-gray to yellowish-gray silt loam about 7 inches thick. The subsurface is a brownish-yellow silt loam with weak platy structure. The upper part of the subsoil, beginning at about 14 inches and extending to 26 or 28 inches, is a uniform yellowish-brown silty clay loam. Next there is a 2- to 4-inch thick zone with a high concentration of silty material. Below 28 or 30 inches the subsoil is a yellowish-brown silty clay loam mottled with gray.

Hosmer is medium acid, and the loess below the subsoil has also been leached of carbonates. Hosmer is low in available phosphorus, and about medium in available potassium.

Some chemical and physical data for a soil profile of Hosmer silt loam are given in Table 14, page 80.

Stonington soils (253)

Stonington soils, in Lawrence county, are light-colored soils formed under forest vegetation on slopes varying from 1 to 12 percent. They have developed from a variety of parent materials including sand, gravel, and silt. In a few cases, sandstone and shale bedrock has influenced the lower portion of the soil profile.

Soil profile. The dominant condition in the areas indicated as No. 253 on the soil map is that the surface soil is a grayish-yellow loam to gravelly loam about 5 inches thick. With depth the material becomes lighter-colored and more gravelly. Nearly pure gravel is found below depths of 15 or 20 inches. This gravelly condition is similar to that found in Stockland loam (155).

In some places the surface is a silt loam and in others it is a sandy loam. Occasionally weathered sandstone or shale makes up the subsoil at depths of about 12 to 15 inches.

These soils are medium to slightly acid and quite variable in available phosphorus and available potassium.

Corn growing on Tice silty clay loam, bottom. Note scouring by flood waters in the foreground. (Fig. 11)

Tice silty clay loam, bottom (284)

Tice silty clay loam is a moderately dark-colored bottomland soil that occurs on the flood plain of the Wabash river (Fig. 11). In organic-matter content and internal drainage, Tice is intermediate between Sawmill silty clay loam (107) and Allison silty clay loam (306), two soils with which it is associated.

Soil profile. The surface soil is a dark-brown to brown silty clay loam about 15 inches thick. From depths of about 15 to 24 inches, the soil is a mottled, dark grayish-brown silty clay loam. Below a depth of 24 inches, it is a lighter-colored grayish-brown silty clay loam mottled with yellow. Tice has some blocky structure. Although this type is moderately slowly permeable to water, it can be drained with tile.

Tice is nearly neutral in reaction. It is about medium in available phosphorus and medium to high in available potassium.

Carmi loam (285)

Carmi loam is a moderately dark-colored terrace soil developed under grass vegetation on slopes ranging from 0 to 4 percent. It occurs in association with Carmi sandy loam (286) and Omaha loam (289) on the broad terrace between Lawrenceville, Illinois, and Vincennes, Indiana. A few slightly depressional areas near the Lawrenceville municipal airport are included with this type. In these areas the surface soil is slightly darker and the depth to gravel slightly greater than is usual for this soil type.

Soil profile. The surface soil is a friable, 10- to 12-inch thick, brown loam containing considerable coarse sand. The subsurface is a light-brown loam 6 to 8 inches thick. Beginning at depths of 16 to 20 inches, the subsoil is only 8 to 10 inches in thickness. It is a yellowish-brown clay loam to gravelly clay loam. Its permeability to water is moderately rapid. Gravel is usually found below depths of 25 to 30 inches and this fact, coupled with the low water-holding capacity of the subsoil, makes Carmi somewhat drouthy. Usually the gravel is calcareous below depths of 60 to 70 inches.

Carmi loam is medium acid, low in available phosphorus, and low to medium in available potassium.

Carmi sandy loam (286)

Carmi sandy loam is a moderately dark-colored soil found in association with Carmi loam (285) and Omaha loam (289) on the terraces along the Wabash river. It frequently occurs on the break between the terrace and the bottomlands. It has developed under grass vegetation on slopes varying from 1 to 7 percent.

Soil profile. The surface soil is a brown to light-brown sandy loam about 8 inches thick. The subsurface is a light-brown sandy loam to loam 6 to 9 inches thick. The subsoil, beginning at depths of 14 to 17 inches, is a yellowish-brown clay loam to gravelly clay loam. Below depths of 25 to 30 inches gravel occurs. Because of the low water-holding capacity of the subsoil and the shallow depth to the underlying gravel this soil is drouthy. The gravel is usually calcareous below a depth of 70 inches. Carmi sandy loam is medium acid, low in available phosphorus, and low to medium in available potassium.

Chauncey silt loam (287)

Chauncey silt loam is a brownish-gray soil developed under forest or mixed grass and forest vegetation on slopes of less than 2 percent. It is sometimes found on upland but usually occurs on colluvial stream terraces that grade gradually into bottomland on one side and more abruptly into upland on the other. In some areas the brownish-gray surface is covered with several inches of lighter-colored silty sediments washed down from surrounding higher land. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a brownish-gray silt loam 8 to 12 inches thick. The subsurface is a gray to light-gray silt loam that has platy structure and is 16 to 18 inches thick. The subsoil, which begins at depths of about 24 to 30 inches, is gray mottled with yellowish brown. It is a plastic silty clay loam with prismatic structure. Below a depth of 40 inches the material usually contains some sand and is somewhat less plastic.

This soil is strongly acid, low in available phosphorus, and low to medium in available potassium.

Petrolia silty clay loam, bottom (288)

Petrolia silty clay loam is a light-colored bottomland soil developed from moderately fine-textured sediments on the flood plains of the Embarrass and Wabash rivers. Some areas in Lawrence county have recently received deposits of light-colored silty sediments several inches in thickness. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter. Areas of Petrolia that are very low-lying and swampy are indicated by swamp symbols on the soil map. This soil type is often associated with Beaucoup silty clay loam (70).

Soil profile. The surface soil is a gray to brownish-gray silty clay loam 6 to 8 inches thick. Below the surface layer the material remains a silty clay loam. It has some blocky structure and is predominantly gray with yellowish-brown mottles. Petrolia is slightly acid to neutral in reaction, low to medium in available phosphorus, and medium to high in available potassium.

Omaha loam (289)

Omaha loam is a moderately dark, grayish-brown terrace soil developed under grass vegetation on slopes of less than 1 percent. It occurs in association with Carmi loam (285) and Carmi sandy loam (286) but usually occupies lower-lying positions and is not so well drained as those two soil types. A few areas in Lawrence county have had several inches of light-colored silty sediment washed onto them from surrounding higher land. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a dark grayish-brown loam 8 to 12 inches thick. The subsurface is a brownish-gray to dark-gray loam about 8 inches thick. The subsoil begins at depths of about 16 to 20 inches and extends to about 30 inches. It is a weakly developed clay loam to gravelly clay loam that is brownish gray in color with some yellowish-brown mottles. Gravel is usually found below depths of 30 to 35 inches. In the upper part of the gravel some clay is present, but in general this soil has a rather low water-holding capacity. It is not quite so drouthy, however, as the Carmi soils because it is lower lying and has a higher water table. Omaha is medium acid, low in available phosphorus, and low to medium in available potassium.

Abington clay loam (300)

Abington clay loam is a dark-colored soil developed in depressional areas on the terraces along the Wabash river. While it probably should be considered a terrace soil, many areas of this type are but very little higher than Wabash silty clay, bottom (83), with which it is frequently associated. Occasional areas of Abington in Lawrence county have had a few inches of light-colored silty sediment washed onto them from surrounding higher land. These areas are indicated on the soil map by a plus sign (+) after the slope-group letter.

Soil profile. The surface soil is a very dark grayish-brown to black clay loam 10 to 12 inches thick. The subsurface is a grayish-brown or dark-gray clay loam 8 to 10 inches thick. Some gravel is present, and often there are rusty iron splotches indicating poor drainage. The subsoil is not well developed but it does have some blocky structure and is a dark-gray to gray clay loam to gravelly clay loam. Below depths of 35 or 40 inches the material becomes more gravelly or sandy, with calcareous gravel usually occurring below 50 inches.

This soil is slightly acid to neutral in reaction, low to medium in available phosphorus, and about medium in available potassium.

Ambraw clay loam, bottom (302)

Ambraw clay loam is a moderately dark-colored bottomland soil developed from moderately fine-textured sediments (Fig. 12). It occurs for the most part along the Embarrass river, although there are some areas in the Wabash river bottoms.

Soil profile. The surface soil is a brown to grayish-brown clay loam 6 to 9 inches thick. The subsurface, 10 to 12 inches thick, is a clay loam to loam. It is dark gray, mottled with yellowish brown. A weakly developed subsoil begins at depths of 16 to 20 inches. It is

Drainage ditch through an area of Ambraw clay loam, bottom. Water disposal is a serious problem on this soil type. (Fig. 12)

a gray clay loam to sandy clay loam mottled with yellowish brown. Gray sandy loam to sandy clay, about neutral in reaction, occurs below 30 inches.

The upper part of the profile is usually slightly acid in reaction, low in available phosphorus, and about medium in available potassium.

Sawmill clay loam, bottom (303)

Sawmill clay loam is a dark-colored bottomland soil derived from fine-textured sediments. It occurs in the old channels or sloughs that traverse the terrace areas along the Wabash river.

Soil profile. The surface soil is a black clay loam to gravelly clay loam 10 to 12 inches thick. The subsurface is a dark grayish-brown gravelly clay loam and extends down to depths of 35 or 40 inches. No true subsoil has developed although there is some blocky structure in this soil. Below a depth of about 35 inches the material usually becomes more gray and contains more sand and gravel.

This soil is slightly acid to neutral in reaction and is moderately high to high in available phosphorus and potassium.

Landes fine sandy loam, bottom (304)

Landes fine sandy loam is a brownish-gray bottomland soil developed from sandy sediments along the Embarrass and Wabash rivers. Its usual occurrence is near either the present channel or former channels of these streams.

Soil profile. The surface soil is a brownish-gray fine sandy loam, variable in thickness, but usually extending to depths of 12 to 18 inches. Below this there is usually a well-drained, yellowish-brown fine sandy loam or fine sand. This soil is neutral to slightly calcareous in reaction throughout the profile. It is permeable to water and plant roots. It is medium to high in available phosphorus and in available potassium.

Palestine loam (305)

Palestine loam is a moderately dark-colored soil developed on slopes ranging between 0 and 5 percent on the Wabash river terraces. It is associated with Carmi loam (285) and Omaha loam (289) but unlike them it was formed partially under forest vegetation. The forest which was growing on this soil type at the time of settlement, however, had not been established long enough to entirely change the characteristics that an earlier stand of prairie grass had given to the soil.

Soil profile. The surface is a 6- to 9-inch thick light-brown to grayish-brown loam. The subsurface is a yellowish-brown loam and the subsoil, beginning at a depth of about 18 inches, is a dark yellowish-brown clay loam to gravelly clay loam. The material below depths of 25 to 30 inches is gravelly, with some clay above 35 inches. The gravel becomes calcareous below depths of 60 to 70 inches. This soil does not hold water well and such crops as corn are apt to suffer some from lack of moisture during most growing seasons.

Palestine is medium to strongly acid, low in available phosphorus, and low to medium in available potassium.

Allison silty clay loam, bottom (306)

Allison silty clay loam is a moderately dark-colored, moderately well-drained to well-drained bottomland soil. Its main occurrence is next to the Wabash river. Some areas included with this soil in Lawrence county have a heavy silt loam surface texture rather than the normal silty clay loam.

Soil profile. The surface soil is a brown to grayish-brown silty clay loam 12 to 15 inches thick. It is neutral to slightly calcareous in reaction. Because of its youthfulness, no distinct horizons have developed in this soil although it does have some blocky structure. With depth it becomes lighter-colored because of less organic matter and below 24 inches it is yellowish brown. There is not much change in texture or reaction throughout the profile. It is about medium in available phosphorus and high in available potassium.

Iona silt loam (307)

Iona silt loam is a light-colored soil developed from loess under forest vegetation on slopes ranging from ½ to 4 percent. In Lawrence county, Iona occurs on upland and on the high loess-covered terrace in the Pinkstaff area. A few very small, very poorly drained spots are included with this soil type in the uplands. Iona is associated with Alford silt loam (308) and Whitson silt loam (116).

Soil profile. The surface is a light brownish-gray silt loam 5 to 7 inches thick. The subsurface is a yellowish-gray silt loam with some platy structure. The subsoil, beginning at depths of 16 to 18 inches, is a silty clay loam with rounded, nutlike structure. It is yellowish-gray mottled with pale yellow and brownish yellow. On the more level areas calcareous loess frequently occurs at depths of 35 to 40 inches.

Iona is medium acid in reaction, low in available phosphorus, and medium in available potassium.

Alford silt loam (308)

Alford silt loam is a light-colored soil developed from loess under forest vegetation on slopes ranging from 1 to 18 percent. In Lawrence county, Alford occurs on upland and on the high loess-covered terrace in the Pinkstaff area.

Besides being shown by itself on the Lawrence county soil map, it is also indicated as a member of the Hickory-Alford soil complex in the areas numbered 8-308 (page 13).

Soil profile. The surface soil is a brownish-gray to yellowish-gray silt loam 4 to 7 inches thick. The subsurface is a brownish-yellow silt loam about 9 inches thick. The subsoil, beginning at depths of 15 to 18 inches, is a yellowish-brown silty clay loam that has well-developed, rounded, nutlike structure. It often has a reddish cast and occasionally may have some faint mottlings below a depth of 35 inches. Calcareous loess occurs at an average depth of about 80 inches. On the steep slopes of the high, upland knob just west of the Wabash river opposite Vincennes, Indiana, some calcareous loess has been exposed by erosion.

Alford is medium to slightly acid in reaction, low in available phosphorus, and medium to high in available potassium.

Some chemical and physical data for a soil profile of Alford silt loam are given in Table 13, page 79.

Keytesville silt loam (309)

Keytesville silt loam is a light-colored soil developed under forest vegetation on slopes ranging from 1 to 10 or 12 percent. In Lawrence county this soil occurs in both upland and high terrace positions. In a few areas it appears to have been formed entirely from shale or sandstone high in clay. In most areas, however, the parent material of the surface horizon was probably loess, with the subsoil being developed from the underlying shale and sandstone bedrock.

Soil profile. The surface soil is a gray to yellowish-gray silt loam 4 to 6 inches thick. The subsurface, 6 to 8 inches thick, is a light-gray silt loam with platy structure. The subsoil, beginning at depths of 10 to 14 inches, is a pale-yellow to olive clay mottled with brownish gray. It has blocky to prismatic structure, is very compact and waxy, and is very slowly permeable to water. It extends to depths of 25 or 30 inches, and immediately below it is partially weathered shale or sandstone high in clay. This soil is medium to strongly acid, low in available phosphorus, and low to medium in available potassium.

Haymond silt loam, bottom (331)

Haymond silt loam is light-colored soil developed from mixed sediments. It occurs for the most part on the Embarrass river flood plain, but is also found in some of the smaller bottoms adjacent to the Embarrass and Wabash bottomlands. It is associated with Wakeland silt loam (333) and Birds silt loam (334) but has a thicker surface soil and is better drained than either of them. It differs from Sharon silt loam, bottom (72), mainly in that it is less acid and is naturally somewhat more fertile.

Soil profile. The surface soil is a brownish-gray to pale-brown silt loam

24 or more inches thick. No true subsoil has developed in this soil. Below the surface horizon the material may become more sandy but is usually a silt loam. It is pale yellowish brown, mixed with some gray below a depth of 35 inches. This soil is slightly acid to neutral in reaction, low to medium in available phosphorus, and about medium in available potassium.

Billett sandy loam (332)

Billett sandy loam is a moderately dark-colored terrace soil developed from sandy sediments on slopes ranging from ½ to 4 percent. This soil was forested at the time of settlement, but trees had not been growing long enough to entirely change the soil features left by an earlier stand of grass. Billett is associated with Unity sandy loam (175) and Bloomfield fine sand (53).

Soil profile. The surface soil is a brown to light-brown sandy loam 6 to 12 inches thick. The subsurface is a yellowish-brown sandy loam or loam extending to a depth of about 30 inches. Subsoil development is usually slight, although sometimes a faint clay and iron oxide accumulation is present between depths of 20 and 30 inches. Below a depth of 35 inches a loose, yellowish-brown sand occurs. This soil is drouthy. It is acid in reaction, and low in available phosphorus and available potassium.

Wakeland silt loam, bottom (333)

Wakeland silt loam is a light-colored soil formed from medium-textured sediments. It occurs mainly in the Embarrass river bottom but is also found in some of the adjacent smaller bottomlands. It is intermediate in many of its characteristics between Haymond silt loam (331) and Birds silt loam (334). It is similar in appearance to Belknap silt loam, bottom (382), but is less acid and somewhat more fertile than Belknap.

Soil profile. The surface soil is a brownish-gray silt loam varying in thickness from 8 to 24 inches. Below the surface layer the material is also a silt loam but it becomes more gray in color. It is slightly acid to neutral in reaction. Where Wakeland is associated with McGary silt loam (173) and Patton (142) and Bonpas (126) silty clay loams (particularly in Township 2 north, Range 12 west, in the southern part of the county) the lower part of the profile is often weakly calcareous. This soil type is low to medium in available phosphorus and medium in available potassium.

Birds silt loam, bottom (334)

Birds silt loam is a light-colored soil developed from silty sediments in the Embarrass river bottomlands. It has a thinner surface soil and is grayer beneath the surface than Haymond silt loam (331) and Wakeland silt loam (333), with which it is associated. Birds resembles Bonnie silt loam, bottom (108), in appearance but is less acid and more fertile than Bonnie. Some areas of Birds silt loam in Lawrence county are depressional and swampy. These areas are indicated on the soil map by swamp symbols.

Soil profile. The surface soil is a brownish-gray silt loam less than 8 inches thick. No true subsoil has developed in the upper 50 inches of this soil. Below the surface layer the material is a gray silt loam. Like the surface, it is slightly acid to neutral in reaction. Birds is low to medium in available phosphorus and about medium in available potassium.

Cottonwood, soft maple, ash, sweetgum, and sycamore do well on Birds silt loam as well as on many of the other poorly drained bottomland soils in Lawrence county. (Fig. 13)

Belknap silt loam, bottom (382)

Belknap silt loam is a light-colored bottomland soil occurring on the flood plains of small streams in Lawrence county. In many of its characteristics it is intermediate between Sharon silt loam (72) and Bonnie silt loam (108).

Soil profile. The surface soil, which varies from 8 to 24 inches in thickness, is a brownish-gray to dark-gray silt loam. Below the surface horizon the material becomes gray to light gray in color. It remains a silt loam, however, with heavier layers of silty clay or clay common below depths of 60 to 80 inches. This soil, where it has not been limed or fertilized, is medium acid in reaction, low in available phosphorus, and low to medium in available potassium.

USE AND MANAGEMENT OF LAWRENCE COUNTY SOILS

After you have studied the descriptions of the soil types on your farm, the next question probably is, "What is the best use and management for them?" To answer this, you'll need to consider not only soil type, but also the slope of the land and the amount of erosion that has taken place. As already mentioned (page 4), these factors were all taken into account when the mapping units were marked out on the soil map. These mapping units, rather than soil type alone, form the basis for the recommendations in this section.

The different mapping units have been combined into 17 groups, according to similarities in their main use and in the problems that are normally encountered in managing them. Not all mapping units in a group will require exactly the same management or soil treatment, however; nor will crop yields be precisely the same. Recommendations must therefore be general. Since this is true, and also since recommendations may change as new information becomes available, you are urged to consult your farm adviser and the local soil conservation personnel for specific, detailed recommendations for the soils on your farm.

Management of Group 1 Soils

Light-colored, poorly to moderately drained, strongly leached silt loam soils with silty clay loam to silty clay subsoils: occurring on "A" (0 to 1 ½ percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

2A	13A	165A	173A
3A	109A	168A	287A, A+
12A	164A	169A	

Drainage needs. Since these soils occur on very gentle slopes or on flats, some means of artificial drainage is necessary. However, all the soils in this group have fine-textured, claypan subsoils that are very slowly to slowly permeable to water, and tile do not function satisfactorily. Tile drainage has been tried on several of the University of Illinois experiment fields on some of these soils, particularly Cisne silt loam (2), but has never materially improved underdrainage or crop yields.

Surface ditches and furrows must therefore be depended upon to remove excess water. Although furrows and drainageways require space that could otherwise be devoted to crops, the drainage they provide on level-lying, impervious, claypan soils usually means the difference between a crop and no crop at all.

Organic-matter and nitrogen needs. These soils are light colored and low in organic matter and nitrogen. It is therefore very important to plow down sod crops regularly. Legume-grass mixtures are preferable. Legumes, if properly inoculated, take nitrogen from the air and store it so that it can be used by the crops which follow. Grasses are particularly effective in granulating soils so that they are mellow and easy to work. Returning crop residues and barnyard manure to the soil also makes valuable contributions to the organic matter supply.

If additional nitrogen is needed it may be supplied by applying suitable commercial fertilizers. The nitrogen problem is discussed more fully in "Nitrogen Recommendations," Illinois Agricultural Experiment Station Mimeograph AG1588, September, 1953.

Maintenance of good structure. Good seedbeds are rather easily prepared on these soils. However, because of their low organic-matter content, they tend to pack easily during rains and to crust over upon drying. Growing sod crops regularly and plowing them under is one of the best ways to maintain good structure in the surface soil and keep it porous to water and air. The best means of getting the roots of such crops as corn to penetrate the claypan subsoil is to fertilize properly and to grow deep-rooting legumes in the rotation. The role of the legumes in loosening up the claypan, however, is not fully understood. This is discussed more fully in the following paragraphs.

Lime, phosphorus, and potassium requirements. These soils are strongly acid and low to very low in available phosphorus and available potassium. On areas that have been farmed for many years with little or no soil treatment, soil tests usually show these needs: (1) 4 to 5 tons of limestone per acre for an 8- to

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 2,** Cisne silt loam, *page 10;* **Type 3,** Hoyleton silt loam, *page 10;* **Type 12,** Wynoose silt loam, *page 13;* **Type 13,** Bluford silt loam, *page 14;* **Type 109,** Racoon silt loam, *page 20;* **Type 164,** Stoy silt loam, *page 24;* **Type 165,** Weir silt loam, *page 24;* **Type 168,** Flora silt loam, *page 25;* **Type 169,** Freeburg silt loam, *page 25;* **Type 173,** McGary silt loam, *page 26;* **Type 287,** Chauncey silt loam, *page 32.*

10-year period; (2) 1,000 to 1,500 pounds of rock phosphate per acre, or its equivalent of superphosphate, for the same period; (3) 400 to 500 pounds of 60-percent muriate of potash per acre for a 4-year rotation. However, because of the wide variations in past soil treatments and management practices, it is very important to test each field and determine its specific requirements. For more information on soil testing see Illinois Agricultural Extension Circular 724, "Soil Treatment Recommendations Based on Soil Tests."

Besides adding needed plant nutrients, soil treatment furnishes another benefit on soils of this group: It increases root penetration and development in the lower layers of the subsoil, making a greater supply of subsoil moisture available for crop production. This was shown by studies of corn on Cisne silt loam at the Toledo, Illinois, Soil Experiment Field in the moderately dry season of 1952.

Where adequate amounts of lime, phosphate, and potash were applied, and crop residues including stover, straw, and standover legumes were plowed down, corn roots penetrated the claypan subsoil and were extensively developed in it (Fig. 14). The zone of most limited root development was just above the claypan — in the gray, platy-structured silty subsurface layer. Corn roots on the untreated check plot were weakly developed and did not penetrate as deeply as on the treated plot (Fig. 15). The yield on the treated plot was 75 bushels an acre; that on the untreated plot, 20 bushels.

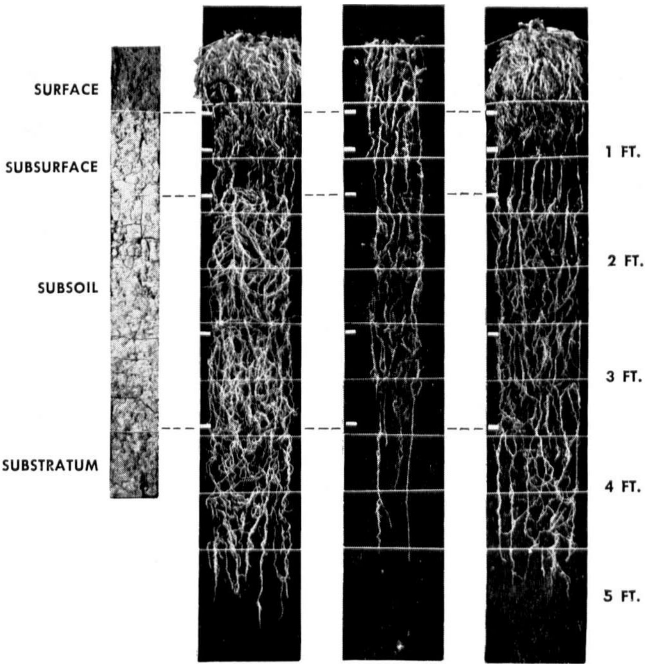
How much deep-rooting legumes help to loosen up the claypan is not entirely clear. That sod crops, both grasses and legumes, help keep the surface soil in good physical condition — porous to water and air — is well established. And there is not much doubt that legumes do help somewhat to loosen up the claypan. However, the claypan remains acid and fairly low in available phosphorus and available potassium even when the surface soil is well treated, and this fact may hinder penetration of legume roots more than roots of corn and other grass crops.

Very little over-all change could be noticed in the structure of the claypan on the treated plot. Most of the roots penetrate the claypan along the faces or sides of the structure aggregates, and it may be that a considerable change takes place there. Upon decaying, a root will leave organic matter and some plant nutrients along its channel. Also, the channel will tend to remain open for a time, allowing freer movement of air and moisture.

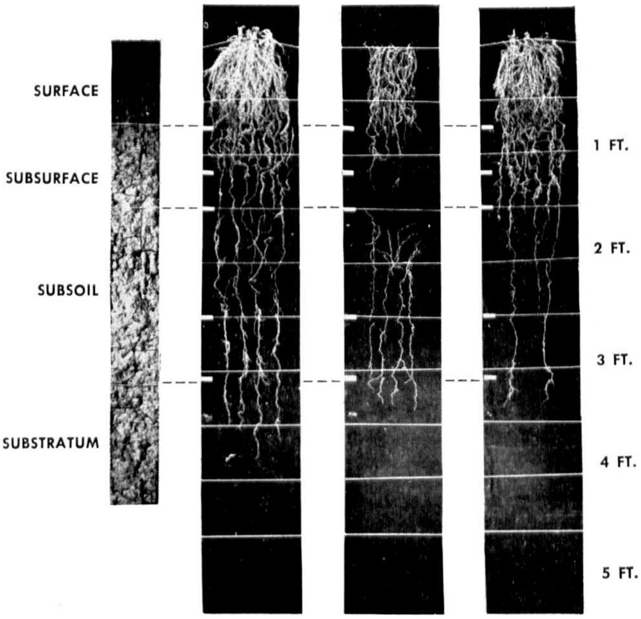
To date experiments with subsoil shattering and subsoil fertilization on soils similar to the claypan soils of southern Illinois have not given good results. Yields have been very little greater than when soil treatment is applied to the surface and legume-grass crops are used in the rotation. Furthermore, the subsoil shattering and subsoil fertilization have proved more expensive.

Erosion control. Erosion usually is not a serious problem on the soils of this management group. However, where slopes approach the upper limits of 1½ percent and are long, it is well to avoid running furrows and ditches as well as row crops up and down the slopes. Row crops may be run across these slopes and furrows plowed across them in a way that will give enough fall for drainage and at the same time prevent serious erosion. For the most part the use of a good crop rotation will keep soil losses from erosion low.

Suitable crop rotations. If good management practices are followed and a



Corn roots from fully treated Cisne silt loam, with soil profile at left. Roots shown in first and third panels came from adjacent hills of corn. Center panel shows roots that came from midway between the two hills. (Fig. 14)



Corn roots from untreated Cisne silt loam (check plot), with soil profile at left. The first and third panels of roots were taken from adjacent hills of corn, while the center panel was taken from midway between the two hills. (Fig. 15) good stand of legumes and grasses are plowed down, a four-year rotation consisting of two row crops, one small grain, and one sod crop may be used on these soils. Where the extra forage can be used profitably, a five-year rotation of two row crops, one small grain, and two sod crops may be more desirable. Another suitable crop sequence is a three-year rotation of one row crop, one small grain, and one sod crop.

It is generally wise to include grasses as well as legumes in the sod crop since the legume may not survive on many areas of these soils that tend to be wet. In case the legume fails, the grass crop will still have a granulating effect on the soil, and if commercial nitrogen fertilizer is used, the rotation need not be disrupted.

Yields from the University of Illinois Soil Experiment Field at Oblong on Cisne silt loam are given in Table 11, page 71. Also yields from the Newton field on Cisne silt loam and Huey silt loam are given in Table 10, page 71.

Management of Group 2 soils

Light-colored, poorly to moderately drained, moderately leached silt loam soils with silty clay loam to silty clay subsoils: occurring on "A" (0 to 1 ½ percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

116A 132A,A+ 208A,A+ 307A

Drainage needs. Adequate drainage is one of the first requirements of good management on these soils. Although they have fine-textured subsoils and slow to moderately slow permeability to water, tile generally function satisfactorily in them if enough sod crops are grown to keep the soils granulated and porous. In many areas, however, open ditches or furrows may provide the best drainage system. A few very wet areas of Type 208 are indicated by a swamp symbol on the soil map.

Organic-matter and nitrogen needs. Because of their light color and low organic-matter content, these soils are low in nitrogen-supplying power. Sod crops, including grasses and legumes, should be grown regularly to replenish the organic-matter supply and to furnish nitrogen for the grain crops. If the soils are too wet for good stands of legumes, nitrogen fertilizers can be used to advantage on the corn crop under normal weather conditions.

Maintenance of good structure. Like the soils of Management Group 1, these light-colored soils tend to pack during rains and to crust over as they dry out. Sod crops are the best known means of keeping the surface soil in good physical condition. The decaying organic matter from the sod crops forms certain chemical compounds that are the main agents responsible for binding the fine soil particles into clumps or aggregates. Since these binding agents will continue to decay, usually breaking down after several years, the organic matter needs to be replenished every few years.

When these soils are wet, they pack easily, so neither machinery nor livestock should be run on them.

Lime, phosphorus, and potassium requirements. The soils of this management group are not as deficient in plant nutrients as are the soils of Group 1. However, they do need treatment, and soil tests should be made and used as

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 116,** Whitson silt loam, *page 21;* **Type 132,** Starks silt loam, *page 22;* **Type 208,** Sexton silt loam, *page 29;* **Type 307,** Iona silt loam, *page 35.*

A rotational pasture on Group 2 soils. To keep these soils in good physical condition, sod crops should be grown at least once every four years. (Fig. 16)

guides in applying soil amendments. These soils are generally low in available phosphorus and about medium in available potassium.

Erosion control. Erosion is not a serious problem on most areas of this group. The use of a good crop rotation as discussed below will usually keep soil losses from erosion low.

Suitable crop rotations. The use of sod crops in the rotation cannot be overemphasized on these soils (Fig. 16). A four-year rotation of two row crops, one grain crop, and one sod crop may be used under good management. With a somewhat less intensive management program, a rotation of two years of row crops, one year of small grain, and two years of sod crops may be used. Grasses as well as legumes should be included in the rotation since some areas of these soils are inclined to be wet, often making it hard for legumes to survive. If the legume should produce a poor stand or fail entirely, commercial nitrogen fertilizers may be used on the following corn crop.

Management of Group 3 Soils

Light- and dark-colored, moderately well- to well-drained, moderately leached silt loam soils with silty clay loam subsoils: occurring on "A" (0 to 1 ½ percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

134A 148A 308A

Drainage needs. Although these soils occur on very gentle slopes, they are naturally well drained or moderately well drained and do not require artificial drainage systems.

Organic-matter and nitrogen needs. Type 148 is dark colored whereas Types 134 and 308 are light colored. While light-colored soils need regular additions of organic matter more than dark-colored soils, the dark soils usually need additional organic matter too. This is because the native soil organic matter decays and releases nitrogen rather slowly. Thus a supply of rapidly decaying organic material, such as is added by plowing down a legume crop, usually increases yields even on the dark soils. If under a very high level of management and productivity, more nitrogen than that supplied by the legume is needed, commercial nitrogen fertilizer should be used.

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 134,** Camden silt loam, *page 23;* **Type 148,** Proctor silt loam, *page 23;* **Type 308,** Alford silt loam, *page 36.*

Maintenance of good structure. Because the soils of this group are well drained or moderately well drained, they are seldom too wet when they are cultivated. They are therefore less likely to be packed by farming operations than are more poorly drained soils. Good physical condition can be maintained by adding organic matter regularly.

Lime, phosphorus, and potassium requirements. Where these soils have been farmed for many years with little soil treatment, they are usually medium to slightly acid, low in available phosphorus, and medium to high in available potassium. Soil tests are the best available guides for the fertility program and should be made before much soil treatment is applied.

Erosion control. Soils of this group are relatively free of erosion problems because they occur on very gentle slopes and are moderately permeable to water.

Suitable crop rotations. Most of the Proctor (148) in Lawrence county occurs in long narrow strips in the Russellville area and is usually farmed with surrounding soils. In areas of this soil that can be farmed separately a three-year rotation such as corn, soybeans, wheat (legume catch crop) may be used. A four-year rotation of two row crops, one small grain crop, and one sod crop is also suggested.

The four-year rotation may be suitable for Types 134 and 308 if particular attention is paid to the management suggestions discussed above. However, a five-year rotation of two row crops, one small grain, and two sod crops may sometimes be more desirable, especially where the additional forage can be used profitably.

Management of Group 4 Soils

Moderately dark- to dark-colored, poorly drained, moderately leached silt loam, loam, and sandy loam soils with silty clay loam to clay loam subsoils: occurring on "A" (0 to 1 ½ percent) and "B" (1 ½ to 4 percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

46A 125A,A+ 170A,B 176A,A+ 200A

Drainage needs. Except for the 170B areas, this group requires artificial drainage for satisfactory crop yields. The permeability of the subsoils is moderately slow to moderate, and tile will provide satisfactory drainage if suitable outlets are available. Adequate tile outlets are sometimes a problem, particularly on Types 125 and 200. Very wet areas of these two soil types are indicated on the soil map by swamp symbols. Types 170 and 176 tile more slowly than the others of this group.

Organic-matter and nitrogen needs. Although these soils are moderately dark to dark and are moderately high in organic matter, they need additions of organic material which will decay readily. It is therefore essential to regularly plow down sod crops, preferably legume-grass mixtures.

Maintenance of good structure. Regularly plowing down sod crops, including legumes, will not only add to the or-

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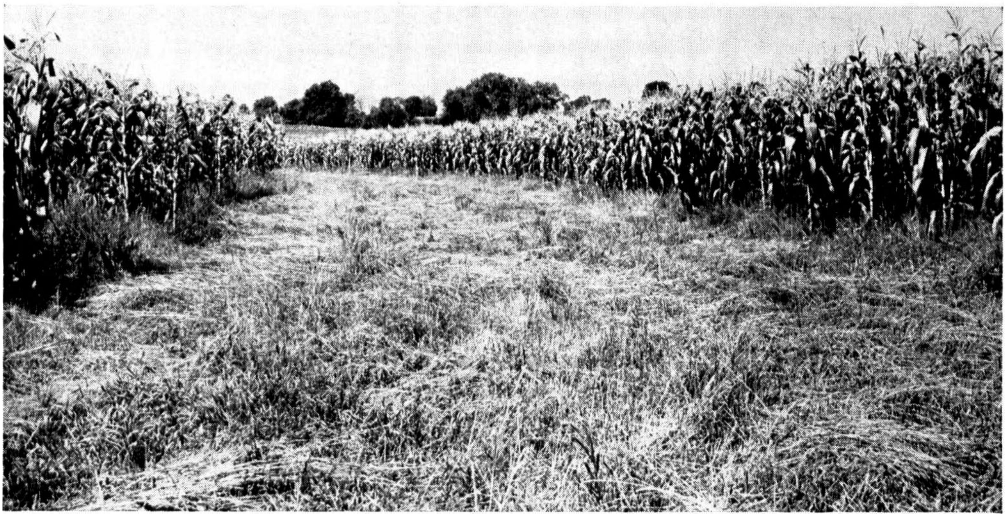
[1] For descriptions of the soil types of which these mapping units are a part, see the follow-pages: **Type 46**, Herrick silt loam, *page 15;* **Type 125**, Selma loam, *page 22;* **Type 170**, Breese silt loam, *page 26;* **Type 176**, Marissa silt loam, *page 27;* **Type 200**, Orio sandy loam, *page 29.*



On sloping soils, such as 170B in Management Group 4, contouring and grass waterways will help to reduce soil losses by erosion. (Fig. 17)

ganic-matter and nitrogen supply but will also help to keep the surface soil granulated and porous to air and water. Working these soils when they are too wet tends to pack the surface soil and in some cases develop a plow sole, although this tendency is not so great as on finer-textured soils.

Lime, phosphorus, and potassium requirements. These soils are variable in their need for soil treatment. Types 170, 176, and 200 are apt to have greater requirements for lime, phosphate, and potash than are Types 46 and 125. There will also be some variation within each of the types because of past use and treatment, as well as some natural variation. The amounts of the various plant nutrients to apply should be determined by soil tests.

Erosion control. There is no erosion problem on the soils of this group, except on 170B. Because 170B is gently sloping some attention should be given to erosion control. If areas of this mapping unit are large enough, erosion can be controlled by using a good crop rotation and by planting row crops across rather than up and down the slope. Occasionally, where water from higher land runs across these soils, a grass waterway may be necessary (Fig. 17).

Suitable crop rotations. A four-year rotation which includes two row crops, one small grain, and one sod crop may be used on these soils. On mapping unit 170B, however, a five-year rotation of two row crops, one small grain crop, and two sod crops is more desirable. A legume-grass mixture is definitely more desirable than just a legume on Types 125 and 200 since they sometimes occur in slightly wet depressions where the legumes may not survive.

Under very good management, a rotation such as corn, soybeans, wheat (legume catch crop) may be used on Types 46 and 125.

Yields on the University of Illinois soil experiment field at Carlinville, which is chiefly on Herrick silt loam, are given in Table 9, page 70.

Management of Group 5 Soils

Moderately dark- to dark-colored, very poorly to moderately drained, moderately to slightly leached silty clay loam to clay loam soils with silty clay loam to clay loam subsoils: occurring on "A" (0 to 1½ percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

50A,A+	126A,A+	284A	302A
70A,A+	142A,A+	300A,A+	303A
107A,A+			

Drainage needs. This group includes low-lying, fine-textured bottomland soils (Types 70, 107, 284, 302, 303), terrace soils (Types 126, 142, and 300), and a soil (Type 50) which occurs on the upland and high, loess-covered terraces. The bottomland soils, unless protected by levees, are subject to overflow from the Embarrass and Wabash rivers. Frequency and duration of flooding vary considerably, but on most cleared areas of these soils, including areas unprotected by levees, summer crops such as corn and soybeans can be grown.

During very high floods the terrace soils also receive some overflow. Ordinarily Type 50 is not subject to stream overflow, but some areas receive runoff water from surrounding higher land and may be ponded for short periods.

Water disposal is one of the most serious problems on all these soils. Fortunately they can be tile-drained satisfactorily, although their low-lying positions sometimes make it difficult to obtain outlets. Most areas that do have adequate drainage today have outlets into large, dredged drainage ditches. Some areas of Types 70 and 126 are very wet and this condition is indicated on the soil map by swamp symbols. It is usually very difficult and perhaps impractical at this time to drain them.

Organic-matter and nitrogen needs. Although these soils are moderately high to high in organic matter, it is important to maintain a fresh supply by plowing down sod crops at regular intervals. Decaying organic matter not only furnishes nitrogen for the grain crops but also has a beneficial effect on soil structure. Commercial nitrogen may often be used profitably for second-year corn or on first-year corn where the preceding legume crop failed or had only a poor stand.

Maintenance of good structure. Much can be done to keep good structure by cultivating or working these soils only when moisture conditions are right. If worked when too wet, these fine-textured soils tend to be cloddy and to develop a compacted zone just below plow depth. Also, the frequent impact of farm machinery causes the granules in the upper few inches to break down. This increases the tendency of these soils to pack and seal over so that water and air cannot enter easily. Fall plowing is desirable, particularly where there is a tendency to plow these soils when they are too wet in the spring.

Growing deep-rooting legumes and grasses is one of the best ways to improve and maintain good structure within plow depth and to loosen up compacted zones just below plow depth.

Lime, phosphorus, and potassium requirements. These soils are moderately

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 50,** Virden silty clay loam, *page 15;* **Type 70,** Beaucoup silty clay loam, bottom, *page 16;* **Type 107,** Sawmill silty clay loam, bottom, *page 20;* **Type 126,** Bonpas silty clay loam, *page 22;* **Type 142,** Patton silty clay loam, *page 23;* **Type 284,** Tice silty clay loam, bottom, *page 31;* **Type 300,** Abington clay loam, *page 33;* **Type 302,** Ambraw clay loam, bottom, *page 33;* **Type 303,** Sawmill clay loam, bottom, *page 34.*

The fine-textured soils of Management Group 5 tend to be cloddy and develop a compact layer just below plow depth. Also, farm machinery may break down surface structure. One of the best ways to keep these things from happening is to include deep-rooting legumes and grasses in the rotation. The pasture shown here is on a nearly level area of Bonpas silty clay loam (126). (Fig. 18)

to slightly leached. Types 107, 126, 142, 284, and 303 have somewhat higher fertility than the other soils of this group. If untreated, they are usually slightly acid to neutral in reaction, medium in available phosphorus, and high in available potassium. Types 50, 70, 300, and 302 are usually slightly acid, low to medium in available phosphorus, and medium to high in available potassium.

The conditions mentioned above, however, are too general for planning a soil treatment program. Soil tests are necessary to show just how much of the various plant food nutrients to apply.

Erosion control. Erosion is not a problem on these soils. Stream bank cutting may be a problem on some areas of the bottomland soils although these soils usually occur back from the stream channels.

Suitable crop rotations. A four-year rotation including one year of grass-legume mixture may be used on these soils (Fig. 18). Another suitable rotation is a three-year crop sequence of corn, soybeans, wheat (legume catch crop). This rotation probably cannot be used on the unprotected bottomland areas because of the danger of flooding on the winter wheat crop. Unprotected bottomland areas may need to be devoted more intensively to summer crops such as corn and soybeans.

Some of these bottomland areas, particularly very wet areas and those outside the levees, have remained in timber. They are among the best soils in the state for the production of timber, and can best be managed for crops of cottonwood, soft maple, ash, sweetgum, and sycamore.

Management of Group 6 Soils

Moderately dark- to dark-colored, very poorly drained, slightly leached silty clay or clay soils with silty clay or clay subsoils: occurring on "A" (0 to 1 ½ percent) slopes with no erosion. This management group includes the following mapping units:[1]

71A 71A+ 83A 83A+

Drainage needs. The drainage problem on these soils is very acute because they are very fine-textured, very slowly to slowly permeable, and often so low-lying as to be swampy. Sloughs and other extremely wet areas are indicated on the soil map by swamp symbols. It is very difficult and often impractical at this time to drain these swampy areas. Even areas that have a drainage ditch are frequently wet late in the spring because they receive runoff from higher land and the underdrainage is very slow. Tile function so slowly on these soils that it probably doesn't pay to install them. A good system of surface ditches is probably the best means of removing excess water.

Both Types 71 and 83 are bottomland soils and are subject to flooding. Where they occur in old channels which traverse the Allison prairie area, east of Lawrenceville, they have a gravelly substratum which helps underdrainage some if the dredged ditches lower the water table enough. Also in this area they are protected by levees and are not subject to as much flooding as the unprotected areas in the Embarrass and Wabash river bottoms.

Organic-matter and nitrogen needs. It is difficult to get legume stands and survival on many areas of these soils. Nevertheless, where possible, organic matter should be added regularly in the form of sod crops. Legumes and grasses that are tolerant to high moisture levels are desirable. Where legumes frequently fail, a grass sod crop plus commercial nitrogen fertilizer may be used. This is particularly important for Type 71, which is not so dark-colored or so high in organic matter as is Type 83. Type 83 is very high in organic matter and if it is adequately drained the need for commercial nitrogen may not be great.

Maintenance of good structure. Because these soils are heavy-textured and inclined to be wet, they are often farmed when puddling and breakdown of the granulated surface structure may occur. Sod crops are therefore extremely important, for they will help to restore or maintain good physical condition in the surface soil. With a favorable surface structure, water will infiltrate and drain through the soil much more easily. Also, growing crops will be better able to take up nutrients from the soil. Fall-plowing of these soils is desirable, especially where there is a tendency to plow them when they are too wet in the spring.

Lime, phosphorus, and potassium requirements. Soil tests should be made to determine how much limestone, phosphate, and potash should be applied. Type 71 usually requires some soil treatment while Type 83 requires very little.

Erosion control. There is practically no erosion on these soils.

Suitable crop rotations. A four-year rotation which includes two row crops, one small grain crop, and one sod crop, or a three-year rotation of corn, soybeans, small grain (legume catch crop) may be used on areas that are adequately drained and are protected from flooding. Unprotected and somewhat wetter areas may have to be farmed largely to corn and soybeans with every effort made to add as much organic matter as possible. Many areas may be devoted more profitably to pasture than to cultivated crops. Whether grown for pasture or for sod crops to turn under, grasses and legumes that are tolerant to wet soil are recommended. These include Reed canary grass, timothy, tall fescue, redtop, alsike clover, white clover, and Ladino clover.

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 71,** Darwin clay, bottom, *page 17;* **Type 83,** Wabash silty clay, bottom, *page 18.*

Timbered areas that are wet and unprotected from flooding can best be managed for crops of cottonwood, soft maple, ash, sweetgum, and sycamore.

Management of Group 7 Soils

Light to moderately dark, moderately well- to well-drained, moderately to slightly leached fine sandy loam, silt loam, and silty clay loam soils with fine sandy loam, silt loam, and silty clay loam subsoils: occurring on "A" (0 to 1½ percent) and "B" (1½ to 4 percent) slopes with slight to no erosion. This management group includes the following mapping units:[1]

72A 75A,B 304A 306A 331A

Drainage needs. These soils do not require artificial drainage systems since they are naturally moderately well to well drained.

Organic-matter and nitrogen needs. It is very important to add organic matter to these soils since they are low to moderate in organic-matter content and nitrogen-supplying power. Organic matter also helps to keep the soil from packing during rains and to keep the surface from crusting as it dries.

Maintenance of good structure. Ordinarily no special precautions are necessary in tilling these soils. It is desirable, however, to work them when moisture conditions are favorable. If this is done, if a good rotation is adopted, and if sod crops are plowed down at regular intervals, the surface soil will be more apt to stay granulated and porous to air and water. Type 306 is finer-textured than the rest of this group. Extra care may therefore be needed to make sure that tilling is done under proper moisture conditions. However, this type contains the most organic matter, which should help to preserve good physical condition in the surface soil.

Lime, phosphorus, and potassium requirements. The soils of this group vary considerably in their soil-treatment requirements. Types 304 and 306 very seldom, if ever, need any limestone or potassium. They are moderately high in available phosphorus but will probably respond to superphosphate, especially on wheat. Types 75 and 331 are slightly acid, low to medium in available phosphorus, and about medium in available potassium. For good crop yields they require some soil treatment but not as much as Type 72, which is medium to strongly acid, low in available phosphorus, and medium to low in available potassium. Soil tests should be used to plan the fertility program most effectively.

Erosion control. Although erosion is not serious on these soils, the more sloping portions, particularly 75B, do have some tendency to erode. However, the good management practices mentioned above, plus a suitable rotation, will usually control erosion on these areas. Since Types 72, 304, 306, and 331 are bottomland soils, they are sometimes subject to stream bank cutting, especially where stream channels become choked with brush and debris. Also, silty deposits are often laid down and shifted about by spring floods where these soils are unprotected by levees.

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 72,** Sharon loam, bottom, *page 18;* **Type 75,** Drury silt loam, *page 18;* **Type 304,** Landes fine sandy loam, bottom, *page 34;* **Type 306,** Allison silty clay loam, bottom, *page 35;* **Type 331,** Haymond silt loam, bottom, *page 36.*

Suitable crop rotations. Where the soil has been fully treated according to soil tests, this rotation may be used: two years of cultivated crops such as corn or soybeans, one year of small grain, and one year of a sod crop such as a legume or legume-grass mixture.

Bottomland Types 72, 304, 306, and 331, where unprotected by levees, are subject to yearly flooding, which frequently drowns out small grain and clover. These types are therefore used more for summer crops such as corn and soybeans.

Management of Group 8 Soils

Light-colored, very poorly to moderately drained, moderately to strongly leached silt loam to silty clay loam soils with silt loam to silty clay loam subsoils: occurring on "A" (0 to 1½ percent) slopes with slight to no erosion. This management group includes the following mapping units:[1]

108A 288A, A+ 333A 334A 382A

Drainage needs. The soils of this group tend to be wet: Underdrainage is slow, and they often occur on low-lying areas back from the stream channel. Because of their slow permeability to water, the use of tile in most areas is questionable. Even though a tile installation occasionally seems to work satisfactorily, a good system of surface ditches is probably the best means of drainage, particularly on Types 108 and 382. If used, tile are apt to function somewhat better in Types 288, 333, and 334 than in the other types. As discussed below, either type of drainage is better where sod crops are grown regularly.

Very wet areas of Types 288, 334, and 382 are indicated on the soil map by swamp symbols. It may be impractical to drain many of these areas at the present time (Fig. 19).

Organic-matter and nitrogen needs. Organic matter should be added to these soils regularly to help keep the surface friable and porous to water and air. Although these soils tend to be wet and are subject to overflow unless protected by levees, legumes should form part of the sod wherever possible, since they can supply nitrogen for the following grain crop. Legumes such as alsike and Ladino clover, which are tolerant to wet conditions often do well on these soils if flooding doesn't last too long. To obtain high crop yields where the legume fails, it may be necessary to use commercial nitrogen and grasses tolerant to wet soil. The grass crops are effective in keeping soils in good physical condition.

Maintenance of good structure. Providing a suitable drainage system and plowing down sod crops regularly will help to maintain good structure. After these steps are taken, the main thing that can be done is to cultivate these soils only when moisture conditions are favorable. Since these soils are light-

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 108,** Bonnie silt loam, bottom, *page 20;* **Type 288,** Petrolia silty clay loam, bottom, *page 32;* **Type 333,** Wakeland silt loam, bottom, *page 37;* **Type 334,** Birds silt loam, bottom, *page 37;* **Type 382,** Belknap silt loam, bottom, *page 38.*

Wet bottomland areas of Management Group 8. Artificial drainage may be impractical on many such areas at present. (Fig. 19)

colored and low in organic matter, cultivating them when they are too wet is likely to cause puddling and destroy granular structure. Also, the use of heavy machinery when the soils are wet, packs the surface and reduces the air and water storage space between the soil particles.

Lime, phosphorus, and potassium requirements. Types 108 and 382 are strongly to medium acid, low in available phosphorus, and low to medium in available potassium. In general they require more soil treatment than do Types 288, 333, and 334, which are slightly acid, low to medium in available phosphorus, and about medium in available potassium. Soil tests should be made and used to guide the soil treatment program.

Suitable crop rotations. Areas where yearly flooding is severe may have to be devoted largely to corn and soybeans. Where flooding is not severe or where these soils are protected by levees, they may be farmed to a rotation that includes one year of sod crops out of four. On Types 108 and 382 a rotation having more sod crops, such as the corn, oats, sod rotation, may be preferable.

Sod crops that are tolerant to wet soil conditions should be chosen. Among the best are tall fescue, redtop, timothy, Reed canary grass, alsike clover, and Ladino clover. These grasses and legumes may often be used for pasture on areas where it is very difficult to secure adequate drainage.

Some wet areas that are subject to flooding have remained in timber. They can be managed best for crops of cottonwood, soft maple, ash, sweetgum, and sycamore.

Management of Group 9 Soils

Light-colored, poorly drained, strongly leached silt loam soils with silty clay loam to clay subsoils: occurring on "A," "B," "C," and "D" (0 to 12 percent) slopes with slight, moderate, and severe erosion. This management group includes the following mapping units:[1]

120A, B, $\bar{B}$ 309A, B, $\bar{C}$, $\underline{C}$, $\bar{D}$

Drainage needs. These two soils are very slowly permeable to water and therefore the flatter areas cannot be drained satisfactorily with tile. Open ditches and furrows must be used. A few areas are depressional and may require rather deep cuts through surrounding ridges in order to get drainage. Unless excess surface water can be removed, it is doubtful if soil treatment will pay on the more level areas.

On the more sloping portions of these soils (those having over 1½-percent slope) drainage becomes less of a problem and erosion becomes serious. Because downward movement of water through the soil profile is slow, more water runs off the surface, increasing the erosion hazard.

Organic-matter and nitrogen needs. These light-colored soils are quite low in organic-matter content and nitrogen-supplying power. They therefore greatly need improvement in these respects. Sod crops, including grasses and legumes, are the best answer to the problem.

Maintenance of good structure. Legumes and grasses will not only help solve the organic-matter and nitrogen problem, but will also aid in keeping the surface soil granulated and porous to air and water. Deep-rooting legumes may benefit subsoil permeability somewhat, although it is not very likely they will materially improve the poor underdrainage.

During normal seasons these soils are extremely wet in the spring and extremely dry in the latter part of summer. Anything that can be done to improve and maintain good structure will tend to lengthen the period during which moisture conditions are favorable for plant growth.

Lime, phosphorus, and potassium requirements. These soils should be treated on the basis of soil tests. The surface soils of both types are usually strongly acid and low in available phosphorus and available potassium. The subsoil of Type 309 is strongly acid; that of Type 120 is usually alkaline. Where the subsoil of this type has been exposed by erosion, it should be tested, but it usually does not need limestone.

An accumulation of excess sodium salts is the main cause for the alkaline subsoil of Type 120. It is not known whether the amount of sodium present is toxic to plants. However, in most spots of this soil, there is enough sodium to keep the clay puddled and in such poor physical condition that roots cannot grow well.

Erosion control. Erosion is not a problem on the depressional to level-lying areas, but it is a very serious problem on slopes greater than about 1 percent. As already mentioned, water infiltrates these soils slowly, and runoff on slopes is therefore high. Greater runoff usually means greater chance for erosion. Erosion is particularly serious on these types because they have very poor subsoils with which very little can be done. An added difficulty on Type 120 is that the surface and subsurface layers are fairly shallow (a total of 7 to 14 inches in uneroded areas). Type 309 usually has a slightly thicker surface and subsurface.

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[1] For descriptions of the soil types of which these mapping units are a part, see the following pages: **Type 120,** Hucy silt loam, *page 21;* **Type 309,** Keytesville silt loam, *page 36.*

To control erosion as well as to make the best use of the limited moisture supply, these soils should be farmed as suggested in the following paragraph.

Suitable crop rotations. These soils often occur in such small areas that they are farmed with surrounding soils. However, since they are dry during the summer, they should not be cropped to corn or soybeans if possible. Instead, greater use should be made of small grains, hay, and pasture. Such a rotation as one year of small grains and three years of hay is suitable on the less sloping, little eroded areas. More sloping and more eroded areas should be kept in pasture.

Management of Group 10 Soils

Light-colored, moderately drained to moderately well-drained, strongly leached silt loam or loam soils with silty clay loam to silty clay subsoils: occurring on "B" (1 ½ to 4 percent) and "C" (4 to 7 percent) slopes with slight, moderate, and severe erosion. This management group includes the following mapping units:[1]

3B, $\overline{\mathrm{B}}$, $\overline{\mathrm{C}}$
4B, C
5C, $\overline{\mathrm{C}}$, $\underline{\mathrm{C}}$
8-14$\underline{\mathrm{C}}$
13B, $\overline{\mathrm{B}}$
14B, C, $\overline{\mathrm{C}}$, $\underline{\mathrm{C}}$
164B, $\overline{\mathrm{B}}$
167B
169B, $\overline{\mathrm{B}}$, $\overline{\mathrm{C}}$
173B, $\overline{\mathrm{B}}$, $\overline{\mathrm{C}}$, $\underline{\mathrm{C}}$
214B, $\overline{\mathrm{B}}$, C, $\overline{\overline{\mathrm{C}}}$, $\underline{\mathrm{C}}$

Drainage needs. Since these soils occur on slopes, any drainage needed is rather easily provided. Some areas of "B" slope near 1½-percent gradient may need some well-placed furrows to carry off excess water. These furrows should be plowed across the slope and have enough fall to carry the water without being so steep as to cause serious cutting in the channel. Areas of "C" slope do not have drainage problems, but erosion, if unchecked, becomes serious. Erosion control is discussed on page 54.

Organic-matter and nitrogen needs. These light-colored soils greatly need organic matter. Types 3, 4, and 167 are somewhat darker colored and higher in organic matter than the other soils of this group; nevertheless, they should also have regular additions of organic matter in the form of sod crops. Legumes should be included in the rotation, but even so additional commercial nitrogen often can be used to advantage. A more detailed discussion of the nitrogen problem is given in "Nitrogen Recommendations," Illinois Agricultural Experiment Station Mimeograph AG1588, September, 1953.

Maintenance of good structure. Including legumes and grasses in the rotation will materially help to keep these soils in good physical condition. Both the sod crops and other organic matter should be plowed down regularly. These practices will help keep the surface from packing and sealing over after rains and will permit freer movement of air and water through the soils. Studies on soils similar to these clearly showed that sod crops will increase the rate at which water moves through the surface soil. Where a good rotation was used the permeability rate was as much as 15 times greater than where the soil had been farmed largely to clean-tilled crops such as corn and soybeans.

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 3,** Hoyleton silt loam, *page 10;* **Type 4,** Richview silt loam, *page 11;* **Type 5,** Blair silt loam, *page 12;* **Types 8-14,** Hickory loam — Ava silt loam, complex, *page 13;* **Type 13,** Bluford silt loam, *page 14;* **Type 14,** Ava silt loam, *page 14;* **Type 164,** Stoy silt loam, *page 24;* **Type 167,** Lukin silt loam, *page 25;* **Type 169,** Freeburg silt loam, *page 25;* **Type 173,** McGary silt loam, *page 26;* **Type 214,** Hosmer silt loam, *page 30.*

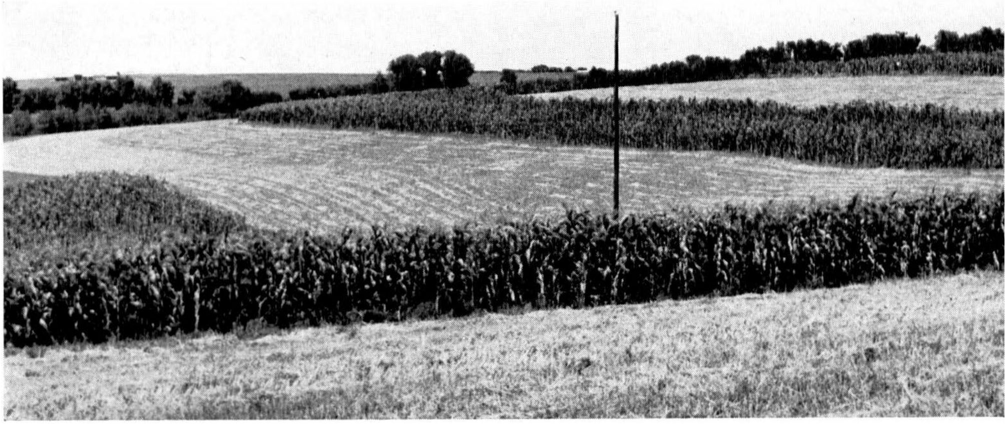
Terraces may sometimes be necessary on soils of Management Group 10. If so, remember that a well-sodded outlet such as that shown here is a very important part of any terrace system. (Fig. 20)

Soils of this group are easily packed if machinery and livestock run on them when they are too wet. These practices should be avoided as much as possible.

Lime, phosphorus, and potassium requirements. All these soils are low in available phosphorus. Types 14, 164, 167, 173, and 214 are about medium in available potassium, while the other soils in this group are generally low in available potassium. Types 164, 173, and 214 are usually somewhat less acid than the others.

The fertility levels mentioned above are for areas that have been farmed for many years with very little soil treatment. They are, however, too general to be used in planning a soil fertility program. Because of both variations in soil characteristics and differences in past management, soil-treatment needs may vary considerably from one area to another. The best way to get proper amounts of soil treatments is to make soil tests. They can often save you money by showing the areas that need less treatment than is called for under the general conditions described above.

Erosion control. These soils, particularly areas of "C" (4 to 7 percent) slope, are likely to erode when farmed to clean-tilled crops. Necessary erosion-control



Strip cropping helps to control erosion on long, fairly uniform slopes. (Fig. 21)

Table 2. — Most Intensive Rotations Recommended for Soils of Management Group 10

(Hoyleton, Richview, Blair, Hickory-Ava complex, Bluford, Ava, Stoy, Lukin, Freeburg, McGary, and Hosmer on "B" and "C" slopes with varying thicknesses of surface and subsurface soil remaining)

Percent of slope	Thickness of surface and subsurface soil	Most intensive rotation with—			
		No conservation practices	Contouring	Strip cropping	Terracing
	inches				
B (1½-4)....	Over 7......	R-G-M-M	R-R-G-M-M-M	R-R-G-M-M-M	R-R-G-M-M
	3-7.........	R-G-M-M-M	R-G-M	R-R-G-M-M-M	R-R-G-M-M
C (4-7)......	Over 7......	G-M-M-M	R-G-M-M-M	R-G-M-M	R-R-G-M-M
	3-7.........	G-M-M	R-G-M-M-M	R-G-M-M	R-G-M
	Less than 3..	G-M-M-M	G-G-M-M	R-G-M-M-M-M	R-G-M-M

R = row crop; G = small grain; M = rotation hay or pasture. For example, an R-G-M rotation has one year of clean-tilled row crops, such as corn or soybeans; one year of small grain; and one year of sod crops in a three-year rotation period.

measures may include grassed waterways, contouring of row crops, and in some cases terraces (Fig. 20). Where slopes are long enough and are fairly uniform, strip cropping may be used (Fig. 21). For specific recommendations for your farm consult your farm adviser and the local soil conservation personnel.

Suitable crop rotations. When choosing rotations for these soils, you will need to consider the erosion hazard. If you adopt conservation practices such as contouring or terracing you can grow more clean-tilled crops, such as corn and soybeans, than if you take no special precautions to control erosion. In Table 2 are indicated the most intensive rotations recommended for various combinations of slope, thickness of remaining surface and subsurface soil, and conservation practice. By locating where your mapping unit fits in columns one and two and reading across to the right, you can determine rotations that may be used with or without various practices to keep soil losses within reasonable limits.

Management of Group 11 Soils

Light-colored, moderately drained to well-drained, moderately leached silt loam soils with silty clay loam subsoils: occurring on "B" (1½ to 4 percent) and "C" (4 to 7 percent) slopes with slight, moderate, and severe erosion. This management group includes the following mapping units:[1]

132B, B̄
134B, B̄, C, C̄, C̲
307B, B̄
308B, B̄, C, C̄, C̲

Drainage needs. These soils usually do not require artificial drainage. However, some well-placed ditches or tile lines may be needed to take care of excess water on some areas of Type 132 where the slope is near 1½ percent, the lower limit of the "B" slope group.

Organic-matter and nitrogen needs. These soils are low in organic matter and nitrogen-supplying power. Regular additions of organic matter in the form of grass-legume mixtures plus manure and crop residues will serve two main purposes. They will increase the nitrogen-supplying power of the soils. Also they will help to keep the soil particles aggregated into clumps or clusters that will resist packing and provide freer movement of air and water.

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 132,** Starks silt loam, *page 22;* **Type 134,** Camden silt loam, *page 23;* **Type 307,** Iona silt loam, *page 35;* **Type 308,** Alford silt loam, *page 36.*

Maintenance of good structure. As mentioned above, sod crops are the best means of improving and maintaining good structure or physical condition in soils. They are especially important on soils low in organic matter since these soils tend to pack and crust or seal over so that air and water movement is restricted.

Air is necessary in the soil because plant roots need oxygen for their living processes just as we do. If the soil is low in oxygen, some of the plant nutrients are not converted to a form that plant roots can use. Furthermore, the roots are not able to take up as many nutrients as they need. Oxygen-starved roots are thickened, short, and usually less permeable to water as well as to plant nutrients.

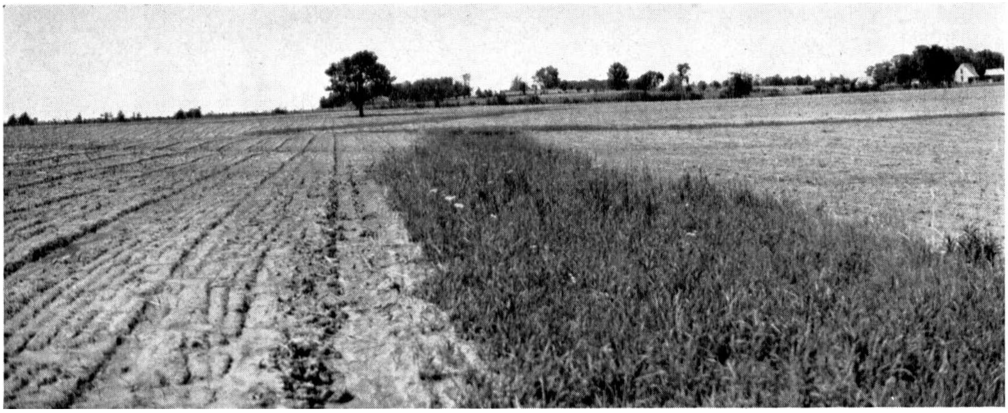
Not only is air movement restricted in soils having poor structure, but water movement is also less free. This means that less rainwater can enter the soil and be available for plant use.

It is apparent from all this that keeping soils well aggregated is one very important step in using and managing them well.

Lime, phosphorus, and potassium requirements. These soils, where untreated, are usually about medium acid, low in available phosphorus, and about medium in available potassium. On the more nearly level areas of Type 307, calcareous silt frequently occurs at a depth of 40 inches or less. This means there is an abundance of limestone at those depths. However, these areas will still need additions of limestone because of leaching in the upper layers. Soil tests should be made to guide the fertility program on all of these soils.

Erosion control. Soils in this group are sloping and are therefore subject to erosion, particularly when cultivated (Fig. 22). Strip cropping, terracing, or contouring is therefore often necessary. Planting a long slope in strips will have

Too-intensive farming caused gullying here. The gully head was at one time full of old wire, tin cans, and other junk which seldom stops gully erosion. Now that the gully head has been well sodded, however, the erosion has been checked. (Fig. 22)



Row crops may be grown on Group 11 soils if erosion-control measures are used. Here a grass waterway prevents scouring in a small draw. (Fig. 23)

the effect of breaking it up into shorter slopes. Terracing will have the same effect by diverting water from a part of the slope to an outlet that can be maintained in permanent sod. Contouring has the effect of many small level terraces. Soil losses from cornfields planted on the contour may be only half as great as from fields planted up and down the slope. Also, corn yields are usually several bushels higher on fields planted on the contour.

Besides the practices mentioned above, grassed waterways are often necessary to control erosion on the soils of this group (Fig. 23). Illinois Extension Circular 593, "Grass or Gullies," gives many helpful suggestions on establishing waterways.

Suitable crop rotations. Table 3 shows the most intensive rotations recommended for the different combinations of slope and erosion on the soils of this management group.

From the standpoint of erosion control less intensive rotations (less corn and soybeans and more hay) are desirable, especially on "C" slopes where less than 3 inches of surface and subsurface soil remain.

Table 3. — Most Intensive Rotations Recommended for Soils of Management Group 11

(Starks, Camden, Iona, and Alford on "B" and "C" slopes with varying thicknesses of surface and subsurface soil remaining)

Percent of slope	Thickness of surface and subsurface soil	Most intensive rotation with—			
		No conservation practices	Contouring	Strip cropping	Terracing
	inches				
B (1½-4)	Over 7......	R-G-M-M	R-G-M	R-R-G-M-M-M	R-R-G-M-M
	3-7.........	R-G-M-M	R-R-G-M-M-M	R-R-G-M-M-M	R-R-G-M-M
C (4-7)...	Over 7......	R-R-G-M-M-M-M	R-G-M-M	R-R-G-M-M-M	R-R-G-M-M
	3-7.........	G-G-M-M	R-G-M-M	R-G-M-M	R-G-M
	Less than 3..	G-M-M-M	G-G-M-M	R-G-M-M-M	R-G-M-M

R = row crop; G = small grain; M = rotation hay or pasture. For example, an R-G-M rotation has one year of clean-tilled row crops, such as corn or soybeans; one year of small grain; and one year of sod crops in a three-year rotation period.

Gully erosion is often serious on soils of Group 12. Concrete flumes are sometimes necessary to stabilize gullies, such as this one, that drain large areas. (Fig. 24)

Management of Group 12 Soils

Light-colored, moderately drained to moderately well-drained, moderately to strongly leached silt loam or loam soils with silty clay loam to clay loam subsoils: occurring on "D" (7 to 12 percent), "E" (12 to 18 percent), and "F" (18 to 30 percent) slopes with slight, moderate, and severe erosion. This management group includes the following mapping units:[1]

5$\overline{\text{D}}$, $\underline{\text{D}}$
8$\underline{\text{D}}$, $\underline{\text{E}}$, $\overline{\text{F}}$, $\underline{\text{F}}$
8-14$\overline{\text{D}}$, $\underline{\text{D}}$, $\overline{\text{E}}$, $\underline{\text{E}}$, $\overline{\text{F}}$, $\underline{\text{F}}$
8-214$\overline{\text{D}}$, $\underline{\text{D}}$, $\overline{\text{E}}$, $\underline{\text{E}}$, $\overline{\text{F}}$
8-308$\underline{\text{D}}$, $\overline{\text{E}}$, $\underline{\text{E}}$, $\overline{\text{F}}$
14D, $\overline{\text{D}}$, $\underline{\text{D}}$
134$\overline{\text{D}}$, $\underline{\text{D}}$
214$\overline{\text{D}}$, $\underline{\text{D}}$, $\overline{\text{E}}$, $\underline{\text{E}}$
308$\overline{\text{D}}$, $\underline{\text{D}}$, $\overline{\text{E}}$, $\underline{\text{E}}$

Drainage needs. Drainage is not a problem on these soils.

Organic-matter and nitrogen needs. All these soils are light colored and low in organic-matter content and nitrogen-supplying power. Most of the mapping units in this group are not suitable for cultivated crops. If legumes as well as grasses are included in the hay and pasture, organic matter and nitrogen are likely to be taken care of.

Maintenance of good structure. If these soils are kept mainly in pasture or hay, as recommended below, soil structure will be good and will need no special attention. About the only precaution needed is to keep livestock off pastures when they are thawing or are very wet.

Lime, phosphorus, and potassium requirements. These soils are all low in available phosphorus. Types 5, 8, and 14 are strongly acid and low to medium in available potassium, whereas Types 134, 214, and 308 are about medium acid and about medium in available potassium. In general, Types 134 and 308 are not as strongly leached as the other soils in this group. They are apt to take somewhat less treatment and are likely to respond better than the other soils. However, for good stands and good growth of legumes and grasses, all these soils require some fertilization. Soil tests should be made and the treatments applied accordingly.

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 5,** Blair silt loam, *page 12;* **Type 8,** Hickory loam, *page 12;* **Types 8-14,** Hickory loam — Ava silt loam, complex, *page 13;* **Types 8-214,** Hickory loam — Hosmer silt loam, complex, *page 13;* **Types 8-308,** Hickory loam — Alford silt loam, complex, *page 13;* **Type 14,** Ava silt loam, *page 14;* **Type 134,** Camden silt loam, *page 23;* **Type 214,** Hosmer silt loam, *page 30;* **Type 308,** Alford silt loam, *page 36.*

Erosion control. Since the mapping units of this group are strongly sloping to steep, erosion control is highly important in their proper use and management (Fig. 24). This need not be a difficult problem, however, if these soils are used mainly for hay, pasture, or forest, as recommended below.

Suitable crop rotations. With proper conservation practices, the least sloping ("D") areas can be used for small grain and hay — unless they have already lost too much soil by erosion (Table 4). More sloping areas should be used for pasture, while very steep areas should be in trees.

For suggestions on reforestation, including methods of planting, varieties to use for various purposes, and costs and returns, refer to "Forest Planting on Illinois Farms," Illinois Extension Circular 567.

For detailed information on establishing pastures, see "Pastures for Illinois," Illinois Extension Circular 647. Circular 703, "Five Steps in Pasture Improvement," also discusses pastures.

Some of the steps necessary for establishing and maintaining high-quality, high-yielding pastures on the soils of Management Group 12 are listed below:

1. Remove brush and fill in gullies.

2. Use terraces and contour furrows where necessary. On some areas these measures may help to hold the soil while a good sod is being established, and also to dispose of excess water during periods of high rainfall.

3. Test soils to determine fertility needs.

Table 4. — Most Intensive Rotations Recommended for Soils of Management Group 12

(Blair, Hickory, Hickory-Ava complex, Hickory-Hosmer complex, Hickory-Alford complex, Ava, Camden, Hosmer, and Alford on "D", "E", and "F" slopes with varying thicknesses of surface and subsurface soil remaining)

Percent of slope	Thickness of surface and subsurface soil	Most intensive rotation with—			
		No conservation practices	Contouring	Strip cropping	Terracing
	inches				
D (7-12)....	Over 7......	G-M M-M	G-G-M-M	R-G-M-M-M-M	R-G-M-M
	3-7.........	Pasture or hay	G-M-M-M	G-G-M-M	R-G-M-M-M
	Less than 3..	Pasture or hay	Pasture or hay	Pasture or hay	Pasture or hay
E (12-18)...	3-7.........	Pasture or hay	Pasture or hay	Pasture or hay	Pasture or hay
	Less than 3..	Pasture	Pasture	Pasture	Pasture
F (18-30)...	3-7.........	Limited pasture or forest	Limited pasture or forest	Limited pasture or forest	Limited pasture or forest
	Less than 3..	Limited pasture or forest	Limited pasture or forest	Limited pasture or forest	Limited pasture or forest

R = row crop; **G** = small grain; **M** = rotation hay or pasture. For example, an R-G-M rotation has one year of clean-tilled row crops, such as corn or soybeans; one year of small grain; and one year of sod crops in a three-year rotation period.

4. Apply fertilizers to correct soil deficiencies.

5. If a mixed pasture is desired, select a suitable combination of grasses and legumes and obtain high-quality, adapted seed.

6. Prepare a good seedbed and seed at proper time.

7. Once the pasture is established, follow these principles of good management: (a) prevent overgrazing, (b) mow to keep down weeds, (c) harrow frequently to scatter droppings from the stock and encourage more uniform grazing.

A well-planned farm pond (Fig. 25, page 63) is a great asset to any pasture program.

Management of Group 13 Soils

Light-colored, very poorly to moderately drained, strongly leached fine sandy loam to sandy loam soils with clay loam to sandy clay subsoils: occurring on "A" (0 to 1 ½ percent) slopes with slight or no erosion. This management group includes the following mapping units:[1]

174A 178A, A+ 184A 187A, A+

Drainage needs. Since Types 178 and 187 often occur on flats or in depressions, the drainage problem, as a rule, is more acute on them than on Types 174 and 184, which usually have some surface drainage. These soils are all slowly to very slowly permeable to water, and because of this, as well as the hazard of tiling through sandy lenses, they must ordinarily be drained with furrows and open ditches. Some depressional areas of Types 178 and 187, if they are to be adequately drained, require rather deep cuts through surrounding higher soils.

Organic-matter and nitrogen needs. These soils are low in organic matter. To obtain satisfactory grain yields it is necessary to regularly plow down organic matter, including grasses and legumes. Most of the rotations suggested for these soils in a later paragraph include a considerable amount of sod crops.

Maintenance of good structure. Soils such as these, with fine sandy loam and sandy loam surfaces, have somewhat different structure than soils containing less sand and more clay. Sand grains are usually less firmly bound with other soil particles into clusters or aggregates. Therefore, sandy soils are less likely to crust and seal over than finer-textured soils. For the same reason, however, they are often subject to "blowing" or movement by wind.

While the problems of good structure are somewhat different on these sandy soils, the solution is about the same as on finer-textured soils. That is, if organic matter which decays readily is incorporated in the surface soil, more of the natural agents which bind or cement the soil particles into clusters will be present to prevent blowing. Also, the tendency of these sandy soils to pack and form plowsoles is minimized if sod crops are grown and systematically returned to the soil.

Lime, phosphorus, and potassium requirements. Although the soils of this group are sandy loams, they usually have moderately fine to fine-textured subsoils. Added soil treatments are therefore not so apt to leach away as on soils that are very sandy to depths of

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 174,** Cowling fine sandy loam, *page 26;* **Type 178,** Ruark fine sandy loam, *page 28;* **Type 184,** Roby fine sandy loam, *page 28;* **Type 187,** Milroy sandy loam, *page 29.*

45 inches or more. Because these soils hold added plant nutrients in reserve reasonably well, they can be fertilized much the same as silt loam soils. In general all soils in this group are acid and low in available phosphorus and available potassium. However, soil tests are necessary to reveal the many variations that may occur in the amounts of soil treatments needed.

Erosion control. Erosion is not a problem on these soils.

Suitable crop rotations. A three-year rotation which includes a row crop, a small grain crop, and a sod crop (grasses and legumes) may be used on these soils. Another suitable crop sequence would be one year of row crops, one year of small grain, and two years of sod crops. Under very good management a rotation of two years of row crops, one year of small grain, and one year of sod crops might be used, although this rotation contains more row crops and fewer sod crops than is desirable for average conditions. Very wet areas that cannot be drained economically may be used for pasture. Sod crops that are tolerant to wet soils include Reed canary grass, timothy, tall fescue, redtop, alsike clover, and Ladino clover.

Management of Group 14 Soils

Light-colored, moderately drained to well-drained, strongly leached fine sand, fine sandy loam, and sandy loam soils with fine sand to clay loam subsoils: occurring on "A" (0 to 1 ½ percent), "B" (1 ½ to 4 percent), and "C" (4 to 7 percent) slopes with slight to moderate erosion. This management group includes the following mapping units:[1]

53A, B 175A, B, C, C̄ 186A, B, C, C̄
174B, C̄ 184B

Drainage needs. Drainage is not a problem on these soils.

Organic-matter and nitrogen needs. The organic-matter and nitrogen problem on these sandy soils is perhaps more serious than on silt loam soils. Not only are these soils naturally low in organic matter, but because they are sandy and porous, the organic matter present, as well as that which is added, decays faster, and released nitrogen is more readily leached away. The problem is particularly acute on Types 53, 175, and 186, which are well drained and have quite permeable subsoils.

For the above reasons, particular attention should be given to replenishing the organic matter of all these soils. Cover crops, such as small grains, during the winter and early spring help to prevent leaching of nitrogen.

Maintenance of good structure. The surface soil of these sandy soils is porous to air and water and is easily worked. From this viewpoint, therefore, maintenance of good structure is not a problem. However, since the sand in these soils is not strongly bound into aggregates and may therefore be subject to "blowing," it is important to preserve good aggregation. Plowing down organic matter (manure, crop residues, and sod crops) will help do this. As the organic material decays, it will furnish the natural compounds which are the principal agents binding soil particles into clusters or aggregates capable of offering some resistance to wind erosion.

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 53,** Bloomfield fine sand, *page 16;* **Type 174,** Cowling fine sandy loam, *page 26;* **Type 175,** Unity sandy loam, *page 27;* **Type 184,** Roby fine sandy loam, *page 28;* **Type 186,** Kincaid fine sandy loam, *page 28.*

Also, growing sod crops regularly in the rotation will help prevent the formation of a plowsole just below plow depth.

Lime, phosphorus, and potassium requirements. In general these soils are acid and are low in available phosphorus and available potassium. The more open and porous soils in this group — Type 53 and to some extent Types 175 and 186 — do not have as high a clay content as the others. For this reason, they cannot store large quantities of the plant nutrients and thus should not receive large amounts of soil treatment at one time. Rather, soil tests should be made and the lime and fertilizers applied primarily to meet the needs of the immediate crop. This means more frequent applications but it will reduce the amounts of plant nutrients lost through leaching. Keeping a cover crop on these soils as much of the time as possible, especially during late winter and early spring, will also tend to prevent excessive leaching.

Types 174 and 184 contain more clay, especially in their subsoils, and the plant nutrients in them are not subjected to serious leaching. On these two soil types, soil treatments may be applied according to soil tests much in the same manner as on silt loam soils.

Erosion control. Because sandy soils are more porous than finer-textured soils, more water can percolate down through their profiles and less runs off the surface. This lessens the water-erosion hazard but does not entirely eliminate it. Wind erosion may be a problem on many areas, particularly on Type 53, and to some extent on Types 175 and 186.

Contouring, strip cropping, and terracing are among the practices that may be needed to control both water and wind erosion. On the more sandy areas that are subject to considerable movement by the wind, strip crops may need to be laid out at right angles to prevailing winds. Shelterbelts of trees may also be necessary. However, keeping the more sandy areas in sod crops most of the time may be the best practice, not only for controlling wind erosion, but also from the standpoint of income.

Suitable crop rotations. Table 5 gives the most intensive rotations recommended for the soils in this group. If these rotations are used, the land will be in sod crops from one-third to three-

Table 5. — Most Intensive Rotations Recommended for Soils of Management Group 14

(Bloomfield, Cowling, Unity, Roby, and Kincaid on "A", "B", and "C" slopes with varying thicknesses of surface and subsurface soil remaining)

Percent of slope	Thickness of surface and subsurface soil	Most intensive rotation with—			
		No conservation practices	Contouring	Strip cropping	Terracing[a]
	inches				
A (0-1½)	Over 7	R-G-M[b]	....	....	....
B (1½-4)	Over 7	R-G-M-M[c]	R-G-M	R-R-G-M-M-M	R-R-G-M-M
C (4-7)	Over 7	R-G-M-M-M	R-G-M-M	R-R-G-M-M-M	R-R-G-M-M
	3-7	G-M-M-M	G-M-M	R-G-M-M	R-R-G-M-M

R = row crop; **G** = small grain; **M** = rotation hay or pasture. For example, an R-G-M rotation has one year of clean-tilled row crops, such as corn or soybeans; one year of small grain; and one year of sod crops in a three-year period.

[a] Terraces may need to be level terraces for greater water conservation as well as for erosion control.

[b] For mapping unit 53A, a rotation such as R-G-M-M is more desirable.

[c] For mapping unit 53B, a rotation such as GM-M-M is more desirable.

When planning your pasture program, don't overlook the value of a farm pond. Great care is needed in locating and building ponds on Group 14 soils, since these sandy soils often have porous strata below the surface and may not hold water well. (Fig. 25)

fourths of the time. Greater use of small grains and hay or pasture is often desirable, since these soils are somewhat drouthy for summer crops such as corn and soybeans. Farm ponds for livestock watering often are a valuable addition to the pasture program (Fig. 25).

Orchard crops such as apples and peaches and drouth-resistant crops such as alfalfa, melons, cantaloupes, and sweet potatoes are well adapted to Soil Types 53, 175, and 186.

Yields of corn and other crops on Oquawka sand are given in Table 8, page 69. Oquawka is intermediate in character between Bloomfield of Management Group 14 and Hagener of Management Group 15.

Management of Group 15 Soils

Moderately dark-colored, moderately well- to well-drained, moderately to strongly leached loamy sand, sandy loam, and loam soils with sand to clay loam subsoils: occurring on "A" (0 to 1 ½ percent), "B" (1 ½ to 4 percent), and "C" (4 to 7 percent) slopes with slight to moderate erosion. This management group includes the following mapping units:[1]

88A, B, C	286A, B, $\overline{B}$, C, $\overline{C}$	305A, B
155A, $\overline{B}$	289A, A+	332A, B
285A, B		

Drainage needs. Drainage is not a problem on these soils although a few areas of Type 289 may require some ditches to lower the water table.

Organic-matter and nitrogen needs. Although these soils are moderately dark-colored and moderately high in organic matter, it is important to regularly plow down organic matter, including sod crops of grasses and legumes. Because these soils are moderately well-drained to well-drained, and also because they are porous, organic matter tends to decay faster than in finer-textured soils. They may therefore need more frequent additions of organic matter. These soils, particularly Types 88, 155, 286, and 332, may lose considerable amounts of nitrogen by leaching if a cover crop or sod crop is not growing on them during late winter and early spring.

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[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 88,** Hagener loamy sand, *page 18;* **Type 155,** Stockland loam, *page 24;* **Type 285,** Carmi loam, *page 31;* **Type 286,** Carmi sandy loam, *page 32;* **Type 289,** Omaha loam, *page 33;* **Type 305,** Palestine loam, *page 35;* **Type 332,** Billett sandy loam, *page 37.*

Maintenance of good structure. Since these sandy soils are porous to air and water, the maintenance of good structure requires no special attention. However, it does need ordinary care, for good aggregation of the soil particles will help to prevent movement by wind action. Liberal use of legumes and grasses in the rotation is the best way to insure good surface soil structure.

Lime, phosphorus, and potassium requirements. These soils require soil treatments in varying amounts and should be tested before soil amendments are applied. All soils in this group are quite permeable and do not hold reserves of plant nutrients well. Therefore, it is important to apply just enough soil treatments for immediate crops. This means, of course, that treatments will have to be more frequent than on soils having greater capacity to hold plant nutrients. Soil types 88, 155, 286, and 332 are more subject to leaching than the others of this group.

Erosion control. Wind erosion is more serious on these soils than water erosion, although some of the "C" slope areas, if unprotected, tend to be eroded by water. Wind erosion is usually most troublesome on Types 88, 286, and 332. The use of the rotations discussed in the following paragraphs, along with such practices as wind strip cropping, will help reduce wind erosion.

Suitable crop rotations. The soils of this group are best adapted to small grains and sod crops. They tend to be drouthy for summer crops having high water requirements, such as corn and soybeans. For this reason the rotations recommended in Table 6 emphasize those crops which make most of their growth during the spring and early summer.

On the more level areas of these soils ("A" and "B" slopes) small grains may be grown more than is indicated in Table 6. Wheat is the favorite crop on these soils, and a rotation such as wheat (lespedeza catch crop), wheat (lespedeza catch crop) may be used. It is very important that the lespedeza growth between wheat crops be plowed under and not removed for hay. This is necessary to supply organic matter and nitrogen and to keep the surface soil well aggre-

Table 6. — Most Intensive Rotations Recommended for Soils of Management Group 15

(Hagener, Stockland, Carmi, Omaha, Palestine, and Billett on "A", "B", and "C" slopes with varying thicknesses of surface and subsurface soil remaining)

Percent of slope	Thickness of surface and subsurface soil	Most intensive rotation with—			
		No conservation practices	Contouring	Strip cropping	Terracing[a]
	inches				
A (0-1½)	Over 7	R-G-M-M	....	R-R-G-M-M-M	....
B (1½-4)	Over 7	R-G-M-M[b]	R-G-M	R-R-G-M-M-M	R-R-G-M-M
	3-7	R-G-M-M-M[b]	R-G-M-M	R-R-G-M-M-M	R-R-G-M-M
C (4-7)	Over 7	G-M-M-M	G-M-M	R-G-M-M-M	R-R-G-M-M
	3-7	G-M-M-M	G-M-M	R-G-M-M-M	R-R-G-M-M

R = row crop; **G** = small grain; **M** = rotation hay or pasture. For example, an R-G-M rotation has one year of clean-tilled row crops, such as corn or soybeans; one year of small grain; and one year of sod crops in a three-year period.

[a] Terraces may need to be level terraces for greater water conservation as well as for controlling erosion.

[b] For Hagener (88B), such a rotation as G-M-M-M is more desirable than those indicated in the table.

gated. Also, regular additions of phosphate and perhaps commercial nitrogen will be necessary for good yields.

Other special crops that are well adapted include many of the vegetables as well as watermelons and canteloupes. Soil types 285, 286, 289, and 305 are well suited to irrigation. However, Types 88, 155, and 332 have such low water-holding capacities that it may be impractical to irrigate them. For more information on irrigation write to the College of Agriculture, University of Illinois, Urbana, Illinois.

Management of Group 16 Soils

Light- to moderately dark-colored, well-drained, strongly leached sandy loam, fine sandy loam, and loam soils with sandy loam to clay loam subsoils: occurring on "A" (0 to 1 ½ percent), "B" (1 ½ to 4 per cent), "C" (4 to 7 percent), and "D" (7 to 12 percent) slopes with slight, moderate, and severe erosion. This group includes the following mapping units:[1]

155$\overline{\mathrm{C}}$, $\underline{\mathrm{C}}$ 175$\underline{\mathrm{C}}$, $\overline{\mathrm{D}}$ 186D, $\overline{\mathrm{D}}$ 253A, B

These soils are not suited for cultivated crops but should be used mainly for pasture. Establishing good pastures on the soils of this group will involve steps similar to those discussed under Management Group 12. It is, however, harder to establish pastures on Group 16 soils than on the silt loam soils of Group 12, because the sandy soils are somewhat drouthy and have a lower moisture-holding capacity.

These soils may need considerable fertilization before good pasture plants, including legumes, can be grown. Soil tests should be made and used as a guide in soil treatment.

"Pastures for Illinois," Illinois Extension Circular 647, contains much useful information on the establishment and management of pastures. It includes the following lists of grasses and legumes that should be considered for sandy soils.

Drouth-resistant grasses and legumes

Bromegrass
Tall oatgrass
Switch grass
Big bluestem

Lespedeza
Sweet clover
Alfalfa
Birdsfoot trefoil

Grasses and legumes tolerant to sandy soil

Bromegrass
Italian ryegrass
Tall oatgrass
Canada bluegrass

Redtop
Alfalfa
Winter vetch
Cowpeas

Management of Group 17 Soils

Light- to moderately dark-colored, well-drained, moderately to strongly leached sand, fine sand, fine sandy loam, and loam soils with sand to sandy clay loam subsoils: occurring on "A" (0 to 1 ½ percent), "B" (1 ½ to 4 percent), "C" (4 to 7 percent) "D" (7 to 12 percent), "E" (12 to 18 percent), and "F" (18 to 30 percent) slopes with slight, moderate, and severe erosion. This management group includes the following mapping units:[2]

53C, $\overline{\mathrm{C}}$, D, $\overline{\mathrm{D}}$
92A, B
155$\underline{\mathrm{D}}$

186$\underline{\mathrm{D}}$, E, $\overline{\mathrm{E}}$, $\underline{\mathrm{E}}$, $\overline{\mathrm{F}}$
253$\overline{\mathrm{B}}$, $\underline{\mathrm{B}}$, $\overline{\mathrm{C}}$, $\underline{\mathrm{C}}$, $\overline{\mathrm{D}}$, $\underline{\mathrm{D}}$

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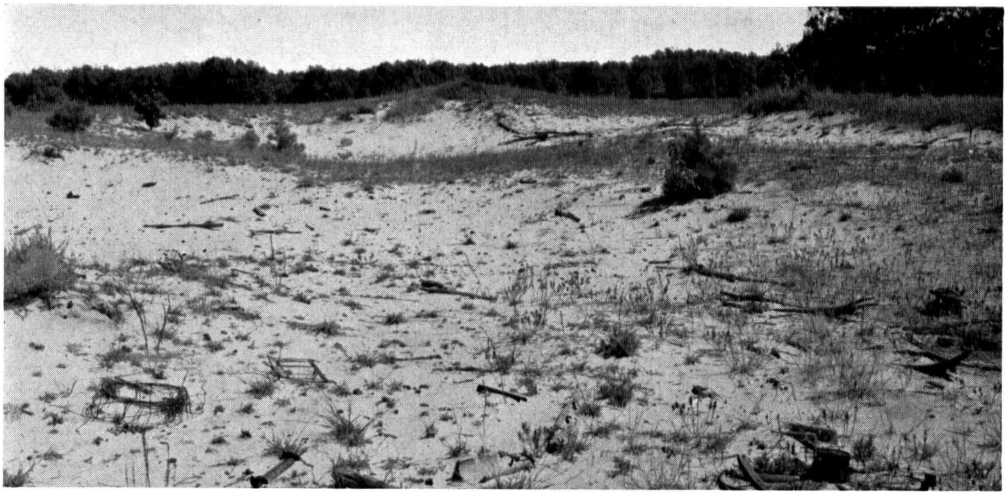
[1] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 155,** Stockland loam, *page 24;* **Type 175,** Unity sandy loam, *page 27;* **Type 186,** Kincaid fine sandy loam, *page 28;* **Type 253,** Stonington soils, *page 30.*

[2] For a description of the soil types of which these mapping units are a part, see the following pages: **Type 53,** Bloomfield fine sand, *page 16;* **Type 92,** Perks sand, bottom, *page 19;* **Type 155,** Stockland loam, *page 24;* **Type 186,** Kincaid fine sandy loam, *page 28;* **Type 253,** Stonington soils, *page 30.*



While blowouts as bad as this one are not common in Lawrence county, the sandy soils of Group 17 are subject to some drifting by the wind. (Fig. 26)

The soils of this group may be used for limited pasture and for woodland. Establishing and maintaining pastures on these soils will require procedures similar to those used for Group 16 and Group 12 soils. The task will be more difficult, however, since these mapping units are even more drouthy than those in Group 16.

Since these soils are drouthy, cultivated crops, such as corn and soybeans, that take large amounts of water in summer, should not be grown. Another reason for avoiding the row crops is that these soils are subject to drifting by the wind unless they are protected by a vegetative cover most of the time (Fig. 26).

Many areas, particularly the steeper and more eroded areas, can be used most profitably for the production of pine forest for Christmas trees, fence posts, and in later years lumber. For information on the planting of trees refer to University of Illinois Extension Circular 567, "Forest Planting on Illinois Farms."

Areas marked 92 on the soil map that are gravel rather than sand have little or no agricultural value.

CHECK YOUR PRESENT MANAGEMENT

The best over-all check of your cropping system and soil-management program is to compare your crop yields with yields obtained on other farms and on experiment fields. For a valid comparison, you need to use the average yields over a period of at least five years. A period this long is necessary to balance out the wide seasonal variations that occur in rainfall, temperature, wind, and insect and disease injury.

Table 7 shows actual farm yields. Table 7 gives average yields to be expected over a period of years under a moderately high level of management. Some of the figures in the table represent actual yields obtained on a particular

Table 7. — AVERAGE YIELDS OF CROPS

To Be Expected on Lawrence County Soils Over a Period of Years Under a Moderately High Level of Management[a]

Figures in **boldface** are based on long-time records kept by farmers in cooperation with the Department of Agricultural Economics; the others are estimated yields.

Type No.	Type name	Hybrid corn	Wheat	Oats	Soybeans	Alfalfa	Mixed pasture
		bu.	*bu.*	*bu.*	*bu.*	*tons*	*days*[b]
2	Cisne silt loam	**53**	**25**	**35**	**25**	2.3	105
3	Hoyleton silt loam	**53**	**26**	**37**	**24**	2.4	110
4	Richview silt loam	50(E)	24(E)	35(E)	22(E)	2.4	110
5	Blair silt loam	43(E)	20(E)	30(E)	18(E)	2.1	100
8	Hickory loam	N	N	N	N	1.5	85
8-14	Hickory loam-Ava silt loam, complex	N	N	N	N	1.7	90
8-214	Hickory loam-Hosmer silt loam, complex	N	N	N	N	1.8	95
8-308	Hickory loam-Alford silt loam, complex	N	N	N	N	1.9	100
12	Wynoose silt loam	**46**	**23**	**30**	**21**	2.0	100
13	Bluford silt loam	**49**	**24**	**34**	**22**	**2.3**	105
14	Ava silt loam	**48**(E)	**22**(E)	**33**(E)	20(E)	**2.3**	105
46	Herrick silt loam	**66**	**32**	**46**	**29**	**2.8**	130
50	Virden silty clay loam	**68**	**30**	**45**	**30**	**2.7**	130
53	Bloomfield fine sand	N	N	N	N	1.5	70
70	Beaucoup silty clay loam, bottom	**51**(D)	24(D)	35(D)	25(D)	2.5(D)	120
71	Darwin clay, bottom	**42**(D)	20(D)	**30**(D)	21(D)	**2.4**(D)	110
72	Sharon loam, bottom	**53**(D)	25(D)	37(D)	24(D)	2.6(D)	130
75	Drury silt loam	56	26	37	24	2.7	120
83	Wabash silty clay, bottom	**58**(D)	23(D)	35(D)	24(D)	N	125
88	Hagener loamy sand	**47**(E)	**23**(E)	33(E)	20(E)	2.0	95
92	Perks sand, bottom	N	N	N	N	1.6	80
107	Sawmill silty clay loam, bottom	65(D)	27(D)	40(D)	30(D)	2.6(D)	130
108	Bonnie silt loam, bottom	45(D)	**20**(D)	30(D)	21(D)	2.0(D)	100
109	Racoon silt loam	**53**	**24**	36	23	2.3	110
116	Whitson silt loam	**52**	**23**	37	24	2.1	110
120	Huey silt loam	28	**20**	**24**	17	**1.5**	75
125	Selma loam	**73**	28	45	31	2.8	130
126	Bonpas silty clay loam	75	28	48	32	3.0	140
132	Starks silt loam	62	26	43	26	2.4	120
134	Camden silt loam	60	27	42	25	2.6	125
142	Patton silty clay loam	**67**	**25**	44	30	2.6	125
148	Proctor silt loam	**70**	26	50	30	**3.0**	140
155	Stockland loam	N	21(E)	35(E)	N	2.2	110
164	Stoy silt loam	**54**	**24**	39	24	**2.5**	120
165	Weir silt loam	51	22	36	23	2.2	105

LETTERS HAVE THE FOLLOWING MEANINGS: **N** = Crop not adapted. **D** = Yields for bottomland types, assuming less than 10 percent damage by flooding. **E** = Erosion by water or wind is often a problem. Estimated yields are for areas which are uneroded or only slightly eroded. Crop adaptation and the kind of cropping systems suitable for controlling erosion depend on the soil type, slope, thickness of remaining surface and subsurface soil, and the conservation practices followed. For detailed information refer to the use and management section of this report.

[a] Moderately high level of management includes adequate drainage; the timely use of adapted cultural practices; careful handling of manure; a cropping system which minimizes erosion and helps maintain good soil tilth and the nitrogen supply; the application of supplemental nitrogen where needed; and the application of limestone, phosphate, and potash where needed in amounts as indicated by soil tests. The crop yield estimates are based on the assumption that during a four-year period, a total of 265 pounds per acre of nitrogen, 150 to 170 pounds per acre of P_2O_5, and 140 to 180 pounds per acre of K_2O were supplied from various sources or estimated available from previous treatments, with each corn crop in the rotation receiving 30 to 40 percent of the total four-year amount.

[b] Estimated number of days that one acre will carry one cow.

(Table 7 is concluded on page 68.)

Table 7. — Concluded

Type No.	Type name	Hybrid corn	Wheat	Oats	Soy-beans	Alfalfa	Mixed pasture
		bu.	*bu.*	*bu.*	*bu.*	*tons*	*days*[b]
167	Lukin silt loam	58	**27**	39	24	2.4	120
168	Flora silt loam	48	23	34	23	2.1	100
169	Freeburg silt loam	51	24	37	24	2.2	105
170	Breese silt loam	59	26	41	27	2.4	120
173	McGary silt loam	46	23	35	23	2.1	100
174	Cowling fine sandy loam	49	22	36	20	2.2	105
175	Unity sandy loam	45	21	32	18	2.1	100
176	Marissa silt loam	60	26	43	27	2.6	125
178	Ruark fine sandy loam	46	21	35	20	2.1	100
184	Roby fine sandy loam	48	22	35	20	2.2	105
186	Kincaid fine sandy loam	44(E)	20(E)	32(E)	18(E)	2.2	100
187	Milroy sandy loam	42	20	31	20	1.8	85
200	Orio sandy loam	53	24	36	23	2.2	105
208	Sexton silt loam	54	25	40	24	2.2	105
214	Hosmer silt loam	53(E)	24(E)	37(E)	22(E)	2.5	115
253	Stonington soils	N	N	N	N	2.2	100
284	Tice silty clay loam, bottom	66(D)	28(D)	42(D)	30(D)	2.7(D)	130
285	Carmi loam	47	**26**	35	23	2.3	110
286	Carmi sandy loam	43	23	30	21	2.2	105
287	Chauncey silt loam	58	25	35	25	2.4	120
288	Petrolia silty clay loam, bottom	**48**(D)	20(D)	35(D)	**22**(D)	2.2(D)	110
289	Omaha loam	51	28	40	26	2.3	110
300	Abington clay loam	62	25	41	29	2.6	125
302	Ambraw clay loam, bottom	48(D)	20(D)	32(D)	21(D)	2.2(D)	110
303	Sawmill clay loam, bottom	65(D)	27(D)	40(D)	30(D)	2.6(D)	130
304	Landes fine sandy loam, bottom	53(D)	25(D)	38(D)	23(D)	2.7(D)	125
305	Palestine loam	44	25	32	22	2.2	105
306	Allison silty clay loam, bottom	65(D)	30(D)	40(D)	30(D)	2.9(D)	135
307	Iona silt loam	63	27	38	26	2.8	125
308	Alford silt loam	61(E)	25(E)	37(E)	24(E)	2.9	130
309	Keytesville silt loam	28	20	22	18	1.7	85
331	Haymond silt loam, bottom	60(D)	30(D)	40(D)	25(D)	2.9(D)	135
332	Billett sandy loam	46	22	32	19	2.1	100
333	Wakeland silt loam, bottom	55(D)	25(D)	35(D)	25(D)	2.8(D)	130
334	Birds silt loam, bottom	50(D)	25(D)	35(D)	24(D)	2.3(D)	110
382	Belknap silt loam, bottom	50(D)	23(D)	35(D)	23(D)	2.4(D)	120

soil type by farmers who kept records in cooperation with the Department of Agricultural Economics, University of Illinois. Other figures have been estimated on the basis of soil characteristics and yields from similar soil types. All the yields used as a basis for estimates, as well as the actual yields given in the table, were obtained under farm conditions. Limestone and fertilizers were applied on the basis of soil tests.

If you find that your average yields for five years or longer are much below those shown in Table 7 for your soil types, it will pay you to examine your management practices to see where changes should be made.

Yields in Table 7 can also be used to compare different soils under the same level of management. From the standpoint of investment in land, however, it should be realized that good management may be more difficult and more costly for one soil than for another.

Experiment fields show higher yields are possible. Yields given in Table 7 do not represent maximum production for the various soil types. Tables 8 to 11 give results from the University of Illinois experiment fields located on soils that are the same as or similar to some of the soils in Lawrence county. These results indicate what can be done on these particular soils with various soil treatments and fair to good cropping systems over a period of years. In general, the yields on the experiment fields are higher than those given in Table 7 for the same soils.

The experiment fields had fair to good crop rotations and large amounts of the various soil treatments in effect for about 25 to 30 years before 1940. The cumulative advantages of this long period of good treatment and management may partly account for the fact that recent yields on these fields were higher than those that many farmers obtained under good management during the same period. Good soil treatment and cropping systems, though, once put into effect, soon result in improved yields. So there is no reason why farmers having soils similar to those in the experiment fields cannot approach the highest yields in Tables 8 to 11.

Whatever the soil type, most farmers in Lawrence county should be able to increase their yields by studying their soils and following the management recommendations made for the various mapping units. Improving on the timeliness of farming operations and putting into effect a sound soil-treatment and cropping system will often pay big dividends.

One practice that will prove worth while in many seasons is to drill superphosphate with wheat and certain other small grains. Corn yields — particularly

Table 8. — OQUAWKA SAND — A SOIL TYPE SOMEWHAT INTERMEDIATE IN CHARACTER BETWEEN BLOOMFIELD (53) AND HAGENER (88)

Average Annual Yields per Acre, 1940-1951

(Oquawka Soil Experiment Field, Henderson County: Standard Treatment Plots of Series 100 to 600)

Treatment	1st year hybrid corn 12 crops[a]	Soybeans 12 crops[a]	Wheat 12 crops	Rye 12 crops	Alfalfa 12 crops
	bu.	*bu.*	*bu.*	*bu.*	*tons*
0	32.4	8.9	6.8	8.7	0
M	50.5**	13.7*	12.6*	11.0	.2
ML	64.2*	17.9‡	22.6*	14.0‡	1.9**
MLP	63.9‡	18.7‡	22.7‡	14.2‡	2.0‡
0	38.7	9.5	8.7	8.3	0
R	45.0	10.1	8.2	8.8	0
RL	55.2†	14.9†	16.7*	12.0*	1.7**
RLP	52.6†	13.8†	16.0†	12.0‡	1.6‡
RLPK	60.0†	19.0‡	19.4‡	12.8‡	2.4‡

CROPPING PRACTICES: corn, soybeans, rye, hay, wheat (le), alfalfa (6 years). The legume (le) was plowed under as a green manure.

KEY TO STANDARD SOIL TREATMENTS APPLIED: **0** = no treatment or check plot; **M** = manure (1 ton for each ton of crops removed); **R** = crop residues (stover, straw, legumes); **L** = limestone; **P** = rock phosphate; **K** = muriate of potash.

[a] 1951 yields missing because of new treatment for first-year hybrid corn and soybeans on first check plot and on residue plot.

* Increase over preceding treatment significant. ** Increase over preceding treatment highly significant. † Increase over check plot significant, but increase over preceding treatment not significant. ‡ Increase over check plot highly significant, but increase over preceding treatment not significant.

yields of second-year corn — are often improved by the use of mixed fertilizers at planting time. Applying additional nitrogen fertilizer either as plowdown or as a side-dressing when corn is nearly knee-high frequently gives additional increases. Small grains are also likely to benefit from nitrogen fertilizers applied in the spring. These fertilizers should not be used, however, if they cause lodging or very rank growth.

In most cropping systems, nitrogen fertilizers should not be considered a substitute for the legume crop. Rather, they should be used as a supplement where more nitrogen than that supplied by the legume can be utilized to advantage. More information on this subject is given in "Nitrogen Recommendations," Mimeograph AG1588, Department of Agronomy, University of Illinois.

Costs can be estimated. In Tables 8 to 11 nothing is given on the costs of treatment. Rather accurate information may be obtained, however, by making soil tests and figuring the cost, at current prices, of the treatment necessary to meet fully the needs indicated by the tests.

Once a high level of fertility is reached, a certain amount of maintenance is required. Both the nutrients lost by cropping and the smaller amounts lost through leaching and erosion need to be replaced. Cost of maintenance can be calculated by determining the amounts of the nutrients lost in different ways and figuring the cost of treatment needed to restore them.

Retesting needed. Retesting after six to eight years will show how well the fertility level has been maintained. Further information on this subject is given in University of Illinois Agronomy Mimeograph AG1359, "Maintenance Requirements for Fertile Soils."

Table 9. — CHIEFLY HERRICK SILT LOAM (46)

Average Annual Yields per Acre, 1942-1953

(Carlinville Soil Experiment Field, Macoupin County: Standard Treatment Plots of Series 100 to 400)

Treatment	1st year hybrid corn 12 crops	Soybeans 12 crops	Wheat 12 crops	Hay 12 crops
	bu.	*bu.*	*bu.*	*tons*
0	42.8	22.0	11.6	.7
M	73.3**	28.1	23.6**	1.7**
ML	90.7‡	32.2‡	29.2‡	3.1**
MLP	91.6‡	32.1‡	33.2‡	3.6‡
0	49.4	23.6	14.3	.9
R	52.5	24.2	14.3	1.0
RL	70.0†	28.1	19.2	2.1**
RLP	76.4‡	29.0	27.5**	2.7‡
RLPK	90.3‡	31.6‡	31.2‡	3.1‡

CROPPING PRACTICES: corn, soybeans, wheat (le), corn, soybeans, wheat, hay, hay. The legume (le) was plowed under as green manure.

KEY TO STANDARD SOIL TREATMENTS APPLIED: **0** = no treatment or check plot; **M** = manure (1 ton for each ton of crops removed; **R** = crop residues (stover, straw, legumes); **L** = limestone; **P** = rock phosphate; **K** = muriate of potash.

** Increase over preceding treatment highly significant. † Increase over check plot significant but increase over preceding treatment not significant. ‡ Increase over check plot highly significant but increase over preceding treatment not significant.

Table 10. — CHIEFLY CISNE SILT LOAM (2) AND HUEY SILT LOAM (120)

Average Annual Yields per Acre, 1942-1953

(Newton Soil Experiment Field, Jasper County: Standard Treatment Plots of Series 100 to 400)

Treatment	1st year hybrid corn 12 crops	Soybeans 12 crops	Wheat 12 crops	Hay 6 crops[a]
	bu.	*bu.*	*bu.*	*tons*
0	5.6	8.4	.2	.1
M	24.5**	14.7**	2.2	.3*
ML	64.9**	23.3**	19.9**	2.0**
MLP	67.8‡	24.4‡	25.1‡	2.5*
0	11.2	10.7	1.0	.2
R	13.4	10.9	.6	.2
RL	33.4**	15.8**	12.0**	1.3**
RLP	36.2‡	16.0‡	17.8*	1.9‡
RLPK	51.5‡	20.8*	21.3‡	2.2‡
RLK	44.4[b]	19.0[b]	12.1[c]	1.2[c]

CROPPING PRACTICES: 1942-1947—corn, soybeans, wheat, redtop (4 years); 1948-1953—corn, soybeans, wheat, hay.

KEY TO STANDARD SOIL TREATMENTS APPLIED: **0** = no treatment or check plot; **M** = manure (1 ton for each ton of crops removed); **R** = crop residues (stover, straw, legumes); **L** = limestone; **P** = rock phosphate; **K** = muriate of potash.

[a] Mixed hay was in the rotation for six years, 1948-1953. [b] For corn and soybeans RLK was not significantly different from RL, RLP, or RLPK, but was highly significant over check. [c] For wheat and hay RLK was not significantly different from RL, significantly lower than RLP, and highly significant over check. For wheat and hay RLPK was highly significant over RLK.

* Increase over preceding treatment significant. ** Increase over preceding treatment highly significant. ‡ Increase over check plot highly significant but increase over preceding treatment not significant.

Table 11. — CISNE SILT LOAM (2)

Average Annual Yields per Acre, 1942-1953

(Oblong Soil Experiment Field, Crawford County: Standard Treatment Plots of Series 100 to 400)

Treatment	1st year hybrid corn 12 crops	Soybeans 12 crops	Wheat 12 crops	Hay 12 crops
	bu.	*bu.*	*bu.*	*tons*
0	18.2	11.3	2.1	.77
M	43.4**	16.7**	7.6**	1.01
ML	76.7**	21.8**	22.7**	1.93**
MLP	80.4**	22.8‡	26.8‡	2.14‡
0	24.1	12.6	3.1	.59
R	32.3	13.3	3.9	.70
RL	52.7*	15.9	15.1**	1.46**
RLP	53.6‡	15.0	20.2‡	1.71‡
RLPK	83.8**	24.6**	23.6‡	2.20*
RLK	74.8[a]	23.4[b]	17.6[c]	1.77[d]

CROPPING PRACTICES: corn, soybeans, wheat, hay.

KEY TO STANDARD SOIL TREATMENTS APPLIED: **0** = no treatment or check plot; **M** = manure (1 ton for each ton of crops removed); **R** = crop residues (stover, straw, legumes); **L** = limestone; **P** = rock phosphate; **K** = muriate of potash.

* Increase over preceding treatment significant. ** Increase over preceding treatment highly significant. ‡ Increase over check plot highly significant but increase over preceding treatment not significant.

[a] For corn RLK highly significant over check, and significant over RL and RLP. RLPK was highly significant over RLK. [b] For soybeans RLK highly significant over check, RL, and RLP, but not significantly different from RLPK. [c] For wheat RLK highly significant over check and not significantly different from RL, RLP, or RLPK. [d] For hay RLK highly significant over check, not significantly different from RL or RLP, and significantly lower than RLPK.

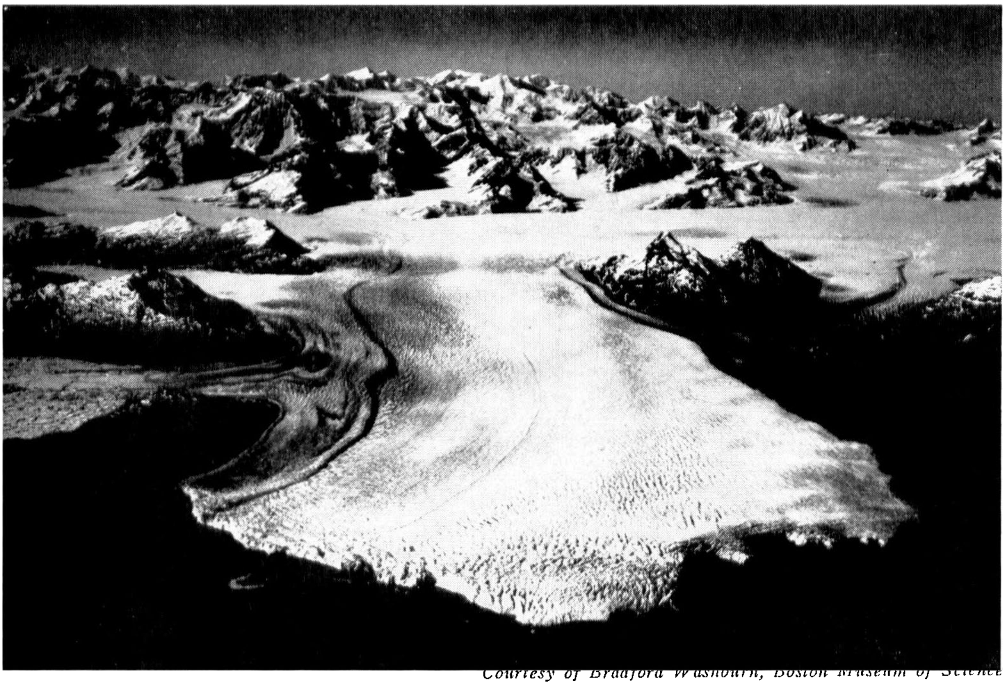
FORMATION AND ASSOCIATIONS OF LAWRENCE COUNTY SOILS

This section of the report has been prepared for those desiring more technical information on the origin and formation of Lawrence county soils and the relationship between the various soil types and soil associations.

Origin of parent materials. The upland and terrace soils are derived from parent materials that were laid down during and immediately after the times when great glaciers reached this area. Some of the terrace (benchland) materials probably have been reworked by both wind and water since the earlier period. The bottomland soils have been formed from sediment deposited more recently. Some of them still receive sediments when streams overflow.

Because of climatic changes during the time known as the Glacial Epoch great quantities of snow and ice accumulated in the northern parts of our continent. The pressures developed in this great ice mass caused it to move outward, forming glaciers. This movement continued until the glaciers reached a region where the climate was warm enough to melt the ice as rapidly as it advanced. (Fig. 27 shows a small Alaskan glacier which is still active.)

In moving across the country, these sheets of ice picked up masses of rock,



Courtesy of Bradford Washburn, Boston Museum of Science

This picture of the Columbia glacier in Alaska illustrates how glaciers form and move. Note that the small valley glaciers in the background have joined together into a large glacier in the foreground. This larger glacier is pushing into Prince William sound. It is approximately 5 miles across at its widest point and about 800 feet thick at its front. Between 200 and 250 feet of ice show above the water. The dark streaks are glacial till imbedded in the ice. This glacier is very small compared with the ice sheets that covered most of Illinois in past ages. (Fig. 27) gravel, sand, silt, and clay, ground them together, and sometimes carried them for hundreds of miles. The moving ice leveled off hills and filled old valleys, often changing the landscape completely.

Two of the glacial advances contributed materials to Lawrence county soils. The Illinoian glacier covered the entire county. Long after the Illinoian ice disappeared, the Wisconsin ice sheet, the last great ice movement, approached to within about 50 miles north of the county. This last ice sheet covered the headwaters of the Wabash and Embarrass rivers, and as it melted, tremendous quantities of water drained through these streams, depositing sediments along their bottomlands.

Throughout the long period during which the Wisconsin ice sheet was melting there were yearly temperature changes as well as long-time mild and cold stages. Varying quantities of water, therefore, poured down the Embarrass and the Wabash, particularly the latter. During the colder spells when the melting of the ice was checked, the bottoms became dry mud flats. Windstorms then picked up "dust" from these flats, sorting it into particles of different size. Sand particles (the larger ones) were deposited close by and the silt (which is fine) was blown farther away and deposited on the uplands. The silty deposit, called "loess," contains considerable amounts of carbonates of calcium and magnesium. (Fig. 28 shows how a windstorm picks up "dust" from bare, dry fields.)

How the soils were developed. As soon as the soil parent materials were laid down, various weathering forces began working on them, and soil development began. When first deposited, these parent materials were high in lime and the mineral elements, but were very low in nitrogen. As time elapsed the rainwater, the oxygen and carbon dioxide of the air, and the products of decaying plant and animal remains attacked the minerals, leaching out the free lime and changing some of the minerals into clay.

Weathering forces are most active near the surface. Various stages or de-

During and near the end of the ice age, dust storms very like this one picked up silty material and redeposited it as loess. It is to loess that the upland soils of Lawrence county owe most of their productiveness. The main sources of loess in the upland of Lawrence county were the Wabash and Embarrass river flood plains. (*This picture was taken in Texas in the spring of 1935 by the U. S. Soil Conservation Service.*)

(Fig. 28)

grees of weathering therefore occur at different depths. Lime is leached first from the surface, and it is also there that decomposition of the minerals is most active. Most of the organic matter accumulates near the surface. The clay particles that form near the surface are carried down by the percolating water and accumulate in the subsoil along with clay that forms in the subsoil. Thus horizons, or layers, differing in physical and chemical composition are formed, and the parent material acquires the characteristics of soil.

The kind of vegetation under which the soils of Lawrence county have developed has influenced the amount of organic matter which they contain. The prairie and swamp grasses, through their extensive fibrous root systems, have added more organic matter to the soil than forest vegetation. Forest vegetation does not add such great amounts of organic matter because trees have a coarser root system, and also because leaves and twigs lie on the surface of the ground, where they oxidize readily.

Drainage and the slope of the land surface are responsible for certain other characteristics in a soil. The poorly drained soils in the depressions are gray, although the color may be masked by the darker organic matter. The soils that developed under good drainage, on the other hand, are yellowish or reddish, although again the color of the surface horizon may be modified by the organic matter present.

Each horizon of a soil has more or less definite characteristics. The horizons are designated as surface, subsurface, and subsoil in the soil-type descriptions. The surface horizon usually contains the greatest amount of organic matter. In slightly weathered soils the subsurface is usually transitional between the surface and subsoil, whereas in highly weathered soils it may be a bleached gray layer low in plant nutrients and organic matter. The subsoil usually contains the greatest amounts of clay, particularly in soils that have undergone considerable weathering.

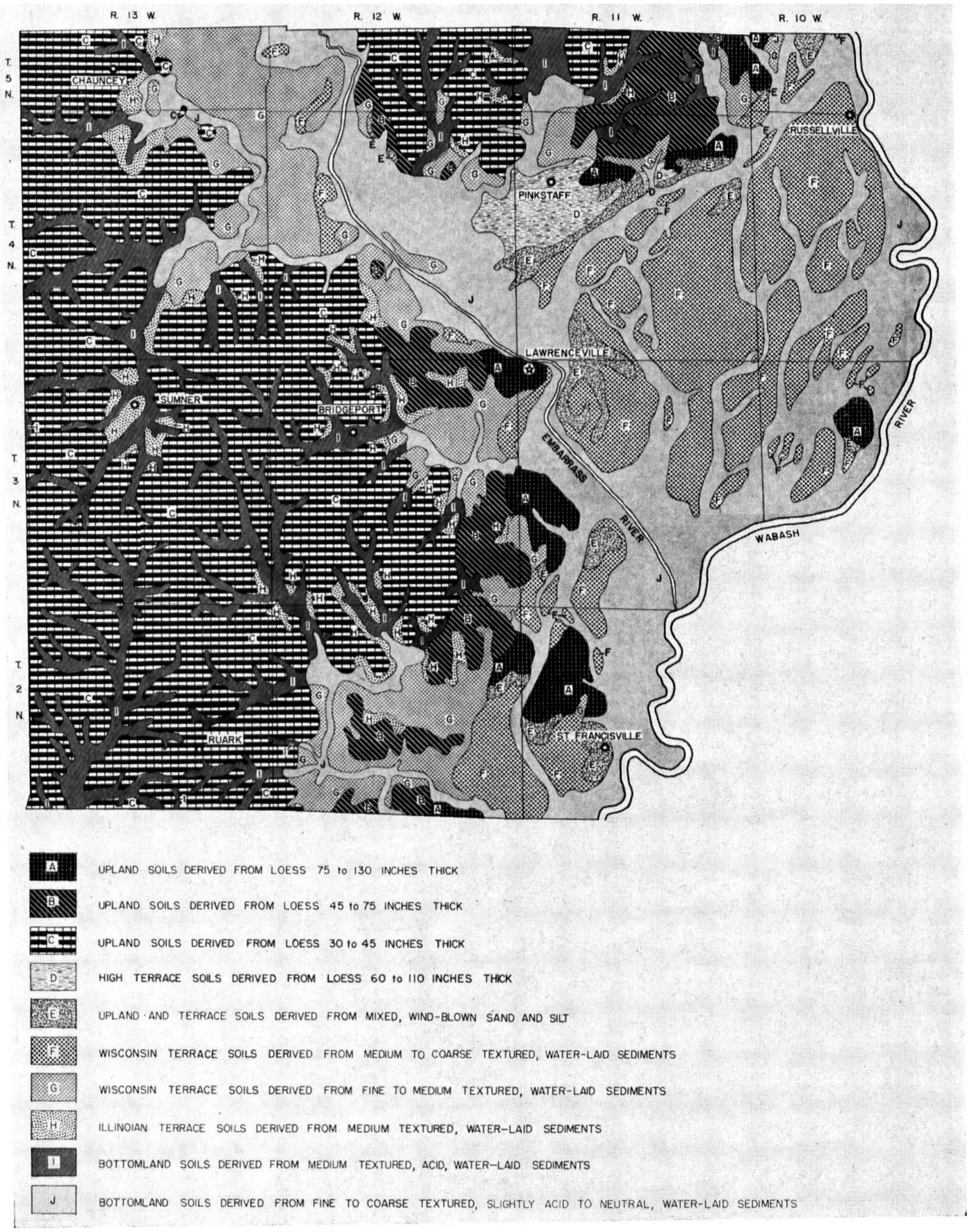
All the layers, or horizons, of a soil taken together make up the "soil profile." Differences in the arrangement, color, and thickness of the various horizons, or in any of their physical features or in their chemical content, are the bases upon which soil types are differentiated and the soil map constructed.

Variations in the soils of Lawrence county thus trace back to differences in parent materials, in native vegetation, and in drainage conditions as influenced by topography.

Soil associations of Lawrence county. The 68 soil types and three soil complexes mapped in Lawrence county can be grouped into ten soil associations on the basis of physiography, parent materials, native vegetation, and natural drainage (Table 12). Fig. 29 shows the location of the different associations in Lawrence county. Following are brief discussions of the soils in each association and of the major factors in their development.

Soil Association A — Upland soils derived from loess 75 to 130 inches thick. The chief members of this association are the light-colored Alford, Iona, and Hickory soils developed under forest vegetation; the moderately dark-colored Breese developed under mixed forest and grass vegetation; and the dark-colored Virden developed under grass vegetation.

These soils occur on flat to steep topography where natural drainage varied from the very poorly drained to the well-drained condition. With the exception of Hickory, which developed


R. 13 W.
R. 12 W.
R. 11 W.
R. 10 W.
T. 5 N.
T. 4 N.
T. 3 N.
T. 2 N.
CHAUNCEY
PINKSTAFF
RUSSELLVILLE
LAWRENCEVILLE
SUMNER
BRIDGEPORT
RUARK
ST. FRANCISVILLE
EMBARRASS RIVER
WABASH RIVER
A UPLAND SOILS DERIVED FROM LOESS 75 to 130 INCHES THICK
B UPLAND SOILS DERIVED FROM LOESS 45 to 75 INCHES THICK
C UPLAND SOILS DERIVED FROM LOESS 30 to 45 INCHES THICK
D HIGH TERRACE SOILS DERIVED FROM LOESS 60 to 110 INCHES THICK
E UPLAND AND TERRACE SOILS DERIVED FROM MIXED, WIND-BLOWN SAND AND SILT
F WISCONSIN TERRACE SOILS DERIVED FROM MEDIUM TO COARSE TEXTURED, WATER-LAID SEDIMENTS
G WISCONSIN TERRACE SOILS DERIVED FROM FINE TO MEDIUM TEXTURED, WATER-LAID SEDIMENTS
H ILLINOIAN TERRACE SOILS DERIVED FROM MEDIUM TEXTURED, WATER-LAID SEDIMENTS
I BOTTOMLAND SOILS DERIVED FROM MEDIUM TEXTURED, ACID, WATER-LAID SEDIMENTS
J BOTTOMLAND SOILS DERIVED FROM FINE TO COARSE TEXTURED, SLIGHTLY ACID TO NEUTRAL, WATER-LAID SEDIMENTS

This map shows the locations of the ten major soil associations found in Lawrence county. These associations are described on pages 74 to 87. (Fig. 29)

Table 12. — LAWRENCE COUNTY SOILS

Grouped According to Physiography, Parent Materials, Native Vegetation, and Natural Drainage

Soil association and physiography	Parent material	Native vegetation	Soil types grouped according to natural drainage				
			Very poor	Poor	Moderate or imperfect	Moderately well	Well
A (Upland)	Loess 75 to 130 inches thick	Timber	...	...	307	8[a], 8-308	308
		Prairie	50	50	...	...	...
		Prairie-timber[b]	...	170	170	...	...
B (Upland)	Loess 45 to 75 inches thick	Timber	...	165	164	214, 8[a], 8-214	...
C (Upland)	Loess 30 to 45 inches thick	Timber	...	12	13, 5[c]	14, 8[a], 8-14	...
		Prairie	...	2, 120, 287	3, 167	4	...
D (High terrace)	Loess 60 to 110 inches thick	Timber	...	116	307	...	308
		Prairie	50	50, 46	46	...	...
		Prairie-timber[b]	...	170	...	...	...
E (Upland and terrace)	Mixed wind-blown sand and silt	Timber	...	309[d]	184	...	186, 53
		Prairie	...	...	...	...	88

(For footnotes see page 77.)

Table 12. — Concluded

Soil association and physiography	Parent material	Native vegetation	Soil types grouped according to natural drainage				
			Very poor	Poor	Moderate or imperfect	Moderately well	Well
F (Wisconsin terrace)	Medium- to coarse-textured, water-laid sediments	Timber..............	178	178	174	....	75, 175, 253
		Prairie...............	300, 125	187, 200, 125	289	289	148, 285, 286, 155
		Prairie-timber[b]........	....	....	....	....	305, 332
G (Wisconsin terrace)	Fine- to medium-textured, water-laid sediments	Timber..............	....	208, 173	173, 132	134	134
		Prairie...............	126, 142	126, 142	....	....	....
		Prairie-timber[b]........	....	176	176	....	....
H (Illinoian terrace)	Medium-textured, water-laid sediments	Timber..............	....	109, 168	169	....	....
		Prairie...............	....	287	167	....	....
I (Bottomland)	Medium-textured, acid, water-laid sediments	Timber..............	108	108	382	72	72
J (Bottomland)	Fine- to coarse-textured, slightly acid to neutral, water-laid sediments	Mixed trees and grass..	334, 288	334, 288	333, 284	331, 306	331, 306
			71, 83, 70	303, 107, 302	....	....	92, 304

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[a] Type 8, Hickory loam, has developed primarily from glacial till on steep slopes.
[b] "Prairie-timber" indicates that timber has invaded a prairie area but has not yet changed entirely the soil features that were developed under the grass vegetation.
[c] Type 5, Blair silt loam, has developed from thin loess (less than 24 inches thick) on leached Illinoian till.
[d] Type 309, Keytesville silt loam, has developed from thin loess (less than 24 inches thick) on shale, or on sandstone high in clay.

from Illinoian till on steep slopes, all the soils of this association were formed from loess. They occur as a discontinuous belt just west of the Wabash river bottomlands and low terraces which were the major sources of loess in this area. The one exception to this is the upland remnant in Section 9, Township 3 north, Range 10 west, near Vincennes, Indiana, which is east of the main loess source and has a thicker loess cover (nearly 300 inches). The soils of this belt are the least weathered of the loess soils. This is shown by comparing the data on Alford and Whitson (Table 13)[1] with those on Hosmer and Weir (Table 14), two soils of Association B, which is the second belt of soils back from the loess source. The B_2 horizons of Alford and Whitson are not so acid as the B_2 of Hosmer and Weir. Also, they have higher base saturation percentages. A comparison of Alford, a well-drained soil, and Hosmer, which is moderately well drained, shows little difference in clay content in the B_2 horizon. The same is true of Whitson and Weir, the poorly drained soils. On the more level-lying areas of Association A, where natural drainage is poor to imperfect, calcareous loess occurs at depths as shallow as 35 or 40 inches. Similar areas of Association B are leached considerably deeper.

Soil Association B — Upland soils derived from loess 45 to 75 inches thick. Hosmer, Stoy, Weir, and Hickory are the main soils of Association B. Having developed under forest vegetation they are all light colored, and with the exception of Hickory, an Illinoian till soil, they are derived from loess. This association makes up the second loess soil belt to the west of the Wabash bottoms and terraces. It occurs just west of Association A and just east of Association C, except that in the Westport area east of the Embarrass river in the northern part of the county, a thin belt of Association B occurs west of Association C. In this area the Embarrass bottoms and terraces contributed enough loess for the soils of Association B to be developed farther west than would be possible from the Wabash loess alone. The soils of Association B are more highly weathered than those of Association A and less highly weathered than those of Association C. The B_2 horizons of Hosmer and Weir of Association B have a higher pH and a somewhat lower clay content than those of Ava and Wynoose of Association C (Tables 14 and 15). In general, the base saturation in the B_2 is higher in Association B soils than in Association C, although it is about the same in the Hosmer and Ava profiles in Tables 14 and 15.

The topography of Association B varies from nearly level to steep and natural drainage ranges from the poor to the moderately well-drained condition. Hosmer silt loam (214) has a moderately well-developed "siltpan" in the lower B and C horizon.

Soil Association C — Upland soils derived from loess 30 to 45 inches thick. Highly weathered soils developed from thin loess on leached Illinoian till make up Association C. The main members of this association are the light-colored Ava, Bluford, Wynoose, Blair, and Hickory soils developed under forest vegetation; and the somewhat darker-colored and thicker-surfaced Richview, Hoyleton, Cisne, Chauncey, and Lukin soils developed under prairie grass. Huey

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[1] Although Whitson was included with Soil Association D in compiling Table 12, a few small areas of Whitson are found in upland positions and can be considered as also belonging to Soil Association A. However, on the soil map the few small areas of Whitson in Soil Association A were included with Iona silt loam (307).

Table 13. — CHEMICAL AND PHYSICAL PROPERTIES OF TWO SOILS OF ASSOCIATIONS "A" AND "D"

Horizon	Depth	pH	Organic carbon[a]	Exchangeable cations[b]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight	Permeability
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay <.002 mm.		
				Alford silt loam (308)[c]— well drained									
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*
A_1	0- 6	5.4	.73	3.0	.6	.4	9.9	41	2.0	85.9	12.1	1.42	.80
A_2	6-12	5.4	.36	4.2	.9	.2	10.6	51	1.8	82.1	16.1	1.39	.62
B_1	12-17	5.2	.24	7.4	2.3	.3	16.9	60	1.3	73.6	25.1	1.43	.78
B_2	17-25	5.2	.22	10.0	3.9	.4	22.9	63	.8	67.3	31.9	1.44	.21
B_3	25-36	5.0	.12	8.3	4.0	.3	21.3	60	1.2	71.0	27.8	1.40	.10
C_1	36-42+	5.1	.09	5.9	3.4	.3	17.0	57	2.6	74.4	23.0	1.44	.14
				Whitson silt loam (116)[d]— poorly drained									
A_1	0- 7	5.3	1.16	2.8	.9	.2	10.7	37	5.3	85.7	9.0	1.34	.33
A_2	7-15	5.2	.14	4.3	2.0	.2	10.7	62	5.4	79.8	14.8	1.47	.39
B_1	15-19	4.9	.16	11.2	7.8	.4	29.3	67	2.3	59.8	37.9	1.51	.07
B_2	19-28	5.4	.22	14.1	9.8	.4	31.3	78	1.6	61.6	36.8	1.46	.03
B_3	28-38	6.8	.13	13.1	8.3	.3	24.6	89	1.3	71.1	27.6	1.55	.03
C_1	38-55	7.0	.12	10.3	6.3	.3	19.5	88	1.6	77.3	21.1	1.45	.03

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[a] Percent organic carbon times 1.724 = percent organic matter.

[b] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

[c] Profile samples taken in Lawrence county, Township 3 north, Range 11 west, Section 18, southeast quarter, northwest 40 acres, southwest 10 acres.

[d] Profile samples taken in Lawrence county, Township 3 north, Range 11 west, Section 19, northwest quarter, northwest 40 acres, southwest 10 acres.

Table 14. — CHEMICAL AND PHYSICAL PROPERTIES OF TWO SOILS OF ASSOCIATION "B"

Horizon	Depth	pH	Organic carbon[a]	Exchangeable cations[b]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight	Permeability
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay <.002 mm.		
Hosmer silt loam (214)[c] — moderately well drained													
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*
A_1	0- 9	5.4	.63	2.0	1.1	.3	9.8	35	2.3	86.0	11.7	1.31	.70
A_2	9-15	4.6	.25	2.4	1.8	.4	13.6	34	1.3	78.1	20.6	1.37	.37
B_1	15-23	4.6	.12	3.1	3.9	.3	19.7	38	1.4	72.2	26.4	1.39	.33
B_2	23-35	4.7	.07	3.3	5.4	.4	22.2	42	1.6	71.3	27.1	1.49	.03
C_1	35-50	4.6	.03	4.8	5.9	1.2	19.1	64	2.6	76.8	20.6	1.55	.04
Weir silt loam (165)[d] — poorly drained													
A_1	0- 8	6.2	.70	6.8	2.1	.3	13.6	69	7.5	79.3	13.2	1.38	.20
A_2	8-17	4.6	.07	2.6	1.0	.3	11.1	37	7.6	77.8	14.6	1.46	.26
B_1	17-21	4.4	.05	4.3	4.0	.5	23.2	39	4.7	65.1	30.2	1.47	.28
B_2	21-39	4.6	.08	10.7	3.7	.5	32.4	48	3.1	58.7	38.2	1.54	.03
B_3	39-46	4.8	.02	7.0	6.7	.4	24.3	60	2.7	70.7	26.6	1.56	.03

[a] Percent organic carbon times 1.724 = percent organic matter.

[b] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

[c] Profile samples taken in Lawrence county, Township 3 north, Range 12 west, Section 2, northwest quarter, northwest 40 acres, southwest 10 acres.

[d] Profile samples taken in Lawrence county, Township 3 north, Range 12 west, Section 2, northwest quarter, northwest 40 acres, northwest 10 acres.

Table 15. — CHEMICAL AND PHYSICAL PROPERTIES OF TWO SOILS OF ASSOCIATION "C"

Horizon	Depth	pH	Organic carbon[a]	Exchangeable cations[b]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight[d]	Permeability[d]
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay[c] <.002 mm.		
Ava silt loam (14)[e]— moderately well drained													
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*
A_1	0- 6	5.2	.96	...	...	....	8.9	61	2.8	80.2	16.4	1.47	.15
A_2	6- 9	4.7	.55	...	...	....	11.1	64	2.2	75.2	22.6	....	...
B_1	9-12	4.3	.39	...	...	....	13.8	53	1.4	71.6	27.0	1.43	.25
$B_{2\text{-}1}$	12-23	4.1	.25	3.7	5.3	....	19.2	43	1.2	67.3	31.5	....	...
$B_{2\text{-}2}$	23-25	4.1	.18	...	...	....	19.6	40	2.0	68.6	29.4	....	...
$B_{2\text{-}3}$	25-33	4.1	.18	...	...	....	21.8	44	1.8	66.3	31.9	1.41	.05
C	33-37	4.4	.16	...	...	....	21.0	60	1.6	69.6	28.8	....	...
D	37-49	4.5	.12	...	...	....	15.9	62	12.4	65.0	22.6	....	...
Wynoose silt loam (12)[f]— poorly drained													
A_1	0- 5	4.4	1.28	...	...	....	9.5	28	4.7	70.5	14.8	....	...
A_2	5-16	4.3	.40	...	...	....	10.0	17	3.2	79.4	17.4	....	...
B_2	16-34	4.0	.22	1.2	4.6	....	28.8	28	1.4	54.5	44.1	....	...
B_3	34-42	4.0	.14	...	...	....	20.6	33	4.0	67.2	28.8	....	...
D	42-51	4.2	.13	...	...	....	....	..	6.8	71.4	21.8	....	...

[a] Percent organic carbon times 1.724 = percent organic matter.

[b] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

[c] Interpolated between .005 mm. and .001 mm. determinations.

[d] Volume weight and permeability core samples taken in Lawrence county.

[e] Profile samples taken in Marion county, Township 1 north, Range 2 east, Section 34, southeast quarter, southeast 40 acres, southwest 10 acres.

[f] Profile samples taken in Jefferson county, Township 1 south, Range 2 east, Section 10, northwest quarter, northeast 40 acres, northeast 10 acres.

silt loam also occurs in Association C. Since soils in this association are highly weathered, even those that developed under prairie grass are relatively light colored. Data from the B_2 horizons of Ava and Wynoose (Table 15) show that they are strongly acid, are low in percent saturation, and have higher maximum clay contents than Hosmer and Weir of Association B (Table 14).

The soils of Association C are poorly to moderately well drained and occur on flat to very steep topography. It is on the more nearly level areas that the soils with well-developed "claypans" such as Cisne and Wynoose have formed.

Soil Association D — High terrace soils derived from loess 60 to 110 inches thick. Soil Association D occurs on the high terrace in the Pinkstaff area. The soils in this area include the light-colored Alford, Iona, and Whitson developed under forest vegetation; the dark-colored Herrick and Virden developed under grass vegetation; and the moderately dark-colored Breese developed under mixed forest and grass vegetation. Except for their terrace position and the fact that the loess is underlain by calcareous sediments of Wisconsin age rather than leached Illinoian till, the soils of Association D are the same as those of Association A. The loess thickness of Association D is somewhat less than that of Association A, but like the loess on the uplands it tends to thicken as it approaches the Wabash river loess source. Some data from two soils, Alford and Whitson, are given in Table 13 and are discussed under Soil Association A.

Soil Association E — Upland and terrace soils derived from mixed, wind-blown sand and silt. Soil Association E includes the light-colored sandy loam and sandy soils, Kincaid, Roby, and Bloomfield, developed under forest vegetation; and the moderately dark-colored, grassland, loamy sand soil, Hagener.

Keytesville, a light-colored silt loam soil, is also included in this association, but only because it occurs in the same general area. It has a different parent material than the other soils, having developed from less than 24 inches of loess over bedrock. It is of very limited extent.

The sandy soils of this association occur on both terrace and upland. They are derived from materials that were first brought down the Wabash and Embarrass rivers as the Wisconsin glacier melted, and that were later reworked by wind. These soils vary in the amount of clay accumulated in the subsoil. Bloomfield and Hagener have very weakly developed B horizons and are therefore subject to rapid leaching. In Table 16 are some data for a profile of Hagener.

The soils of Association E have developed under a range of natural drainage conditions. Keytesville is naturally poorly drained, Roby imperfectly drained, and the others well drained.

Soil Association F — Wisconsin terrace soils derived from medium- to coarse-textured, water-laid sediments. The Wisconsin-age, water-laid terraces of Lawrence county are shown in Fig. 29 in two associations. Association F includes those soils that developed from medium- to coarse-textured materials laid down by relatively swift-flowing melt waters from the Wisconsin glaciation. Association G includes those soils developed from fine- to medium-textured materials laid down in slack water or relatively slow-flowing water. The boundary or separation of these two associations is not sharp, some medium-textured soils being placed in one group and some in the other group mainly on the basis of their geographical occurrence within the county.

Table 16. — CHEMICAL AND PHYSICAL PROPERTIES OF HAGENER LOAMY SAND (88),[a] SOIL ASSOCIATION "E"

Horizon	Depth	pH	Organic carbon[b]	Exchangeable cations[c]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight	Permeability
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay <.002 mm.		
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*
A_1	0-16	6.0	.42	4.1	.3	.2	8.2	57	84.3	9.1	6.6	1.58	11.76
A_3	16-26	5.8	.19	2.6	.3	.1	5.8	53	84.1	9.4	6.5	1.58	12.83
B-C	26-34	5.8	.12	2.5	.3	.1	5.4	56	85.9	8.4	5.7	....	.....
C_1	34-80	5.8	.01	1.7	.2	.1	3.3	64	93.1	3.1	3.8	1.61	5.08
C_2	80-110	6.0	.03	2.0	.4	.1	3.8	68	92.4	3.7	4.2	....	.....

[a] Profile samples taken in Lawrence county, Township 3 north, Range 11 west, Section 10, northwest quarter, southwest 40 acres, northwest 10 acres.
[b] Percent organic carbon times 1.724 = percent organic matter.
[c] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

Table 17. — CHEMICAL AND PHYSICAL PROPERTIES OF CAMDEN SILT LOAM (134),[a] SOIL ASSOCIATION "G"

Horizon[b]	Depth	pH	Organic carbon[c]	Exchangeable cations[d]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight	Permeability
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay <.002 mm.		
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*
A_2	5½-12	6.8	.60	4.9	1.8	.2	10.2	70	15.5	60.5	12.0	1.35	.71
$B_{2\text{-}1}$	18-23	4.9	.12	5.0	2.1	.3	16.6	45	15.3	29.9	27.4	1.52	.34
$B_{2\text{-}2}$	23-30	4.8	.13	4.7	2.7	.3	17.8	43	21.0	23.0	28.0	....	...
$B_{2\text{-}3}$	30-40	4.8	.14	5.7	3.6	.3	20.4	47	10.1	31.1	29.4	1.53	.19
B_3	40-48	4.8	.10	5.8	3.7	.3	21.3	46	4.3	37.3	29.2	....	...
C_1	48-60	4.6	.07	5.0	3.4	.3	18.2	48	19.5	29.9	25.3	....	...

[a] Profile samples taken in Lawrence county, Township 4 north, Range 12 west, Section 21, southeast quarter, northeast 40 acres, northwest 10 acres.
[b] Analyses were not run on the following horizons: A_p 0-5½ inches, A_3 12-15 inches, $B_1$15-18 inches.
[c] Percent organic carbon times 1.724 = percent organic matter.
[d] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

Association F includes sandy loam, fine sandy loams, and loam soils for the most part, although Drury and Proctor, two silt loam soils, and Abington, a clay loam soil also occur in this area.

Ruark, Cowling, Unity, Stonington, and Drury have developed under forest vegetation and are light colored. Natural drainage varied from very poor to well drained. Abington, Selma, Milroy, Orio, Omaha, Proctor, Carmi, and Stockland have developed under prairie grass or swamp grass vegetation and are moderately dark to dark colored. Natural drainage varied from very poor in the Abington to well drained in the Carmi (Table 12, page 77). Palestine and Billett, two naturally well-drained soils, have developed under mixed forest and grass vegetation and are moderately dark colored. It is also probable that some areas of Milroy, mentioned above as having developed under grass, had some forest present as well as grass vegetation.

Soil Association G — Wisconsin terrace soils derived from fine- to medium-textured, water-laid sediments. The most extensive soils of Association G are those terrace soils, McGary, Marissa, Patton, and Bonpas, that have developed from Wisconsin-age, fine-textured materials deposited as slack-water sediments. Also included in this association are some soils derived from medium-textured Wisconsin-age materials. These are the Sexton, Starks, and Camden soils. They are included in Association G because they occur in the same parts of Lawrence county, and since they are not extensive in area, could not be shown separately on the small scale map of Fig. 29.

Patton and Bonpas are moderately dark to dark-colored, low-lying, nearly level, naturally poorly to very poorly drained soils developed under mixed prairie and swamp grass and forest vegetation. Bonpas shows very little if any influence of forest vegetation, whereas forest influence is usually evident in Patton. Marissa has developed under mixed forest and grass and is intermediate in many respects between Patton and McGary, a light-colored soil developed under forest.

Sexton, Starks, and Camden are all light colored, having developed under forest vegetation. Sexton is naturally poorly drained, Starks is imperfectly drained, and Camden is naturally moderately well to well drained. Some profile data for Camden silt loam are given in Table 17. These data are considered representative of the Camden of Lawrence county. It may be somewhat more weathered than some Camden occurring farther north in Illinois since it has slightly lower pH and lower base saturation values. On the other hand, the Lawrence county Camden has slightly higher calcium to magnesium ratios than some. Also it is not as shallow to sand as are many areas of Camden farther north and therefore probably not as drouthy.

Soil Association H — Illinoian terrace soils derived from medium-textured, water-laid sediments. Soil Association H is composed of the light-colored Racoon, Flora, and Freeburg soils that have developed under forest vegetation and the somewhat darker and thicker-surfaced Chauncey and Lukin soils developed under prairie grass. These soils are called Illinoian terrace soils even though most of them probably have been influenced by thin loess of Wisconsin age. In degree of weathering and development the soils of Association H are about comparable to Association C (upland soils derived from loess 30 to 45 inches thick).

Flora, a naturally poorly drained soil,

and Freeburg, an imperfectly drained soil, are underlain by mixed sediments probably washed from surrounding Illinoian till. In some cases the underlying material seems to be till that has been only slightly reworked by water.

Racoon and Chauncey are naturally poorly drained and Lukin is naturally imperfectly drained. These three soils usually occur in colluvial areas where medium-textured sediments have been washed down from soils on surrounding higher areas. They have thicker A horizons or greater depth to the B horizon (more than 24 inches) than do Flora and Freeburg.

Soil Association I — Bottomland soils derived from medium-textured, acid, water-laid sediments. The three soils of Association I, Bonnie, Belknap, and Sharon, are all light-colored silt loam soils that occur chiefly in the smaller bottomlands of Lawrence county. They have developed from sediments washed down from acid, upland loess and Illinoian till soils. All these bottomland soils were forested, but it is difficult to determine the influence of the forest vegetation on them since the sediments from which they are derived were originally light colored.

Bonnie is naturally very poorly to poorly drained and may have as much as 8 inches of a slightly darkened surface layer. Belknap is imperfectly drained for the most part and the slightly darkened surface layer may vary from about 8 to 24 inches in thickness. Sharon is naturally moderately well to well drained and usually has over 24 inches of slightly darkened surface soil.

Soil Association J — Bottomland soils derived from fine- to coarse-textured, slightly acid to neutral, water-laid sediments. Soil Association J is a broad grouping of bottomland soils which vary from light to dark in color. They may also be anywhere from well drained to very poorly drained. They have in common the fact that their slightly acid to neutral character reflects the influence of sediments washed from Wisconsin-age materials.

Birds, Wakeland, and Haymond (all light-colored silt loam soils) have about the same relationship to each other as do Bonnie, Belknap, and Sharon of Association I. However they are not as acid or as highly leached as Bonnie, Belknap, and Sharon and probably have somewhat better water-holding and water-supplying capacities.

Three other soils of this association having much in common, except natural drainage, are Sawmill, Tice, and Allison. Sawmill is naturally poorly drained and dark colored. Tice is also dark colored but is imperfectly drained. Allison is moderately dark colored and moderately well to well drained. These three soils are all silty clay loams throughout their profiles with the exception that in the Sawmill a clay loam type also was mapped. Ambraw clay loam, a moderately dark-colored, poorly drained soil would also fit into this same subgroup of the slightly acid to neutral bottomlands.

Petrolia and Beaucoup silty clay loams are often closely associated in Lawrence county. Both are naturally very poorly to poorly drained. Petrolia is light colored but may have as much as 8 inches of slightly darkened surface soil. Beaucoup is moderately dark colored.

Landes fine sandy loam and Perks sand are closely associated and usually occur near the channels of the Wabash and Embarrass rivers. Both are naturally well drained. Perks, in general, may be of very recent origin, and in Lawrence county some rather large areas of gravel are included. Perks is light colored

Table 18. — CHEMICAL AND PHYSICAL PROPERTIES OF DARWIN CLAY, BOTTOM (71),[a] SOIL ASSOCIATION "J"

Horizon	Depth	pH	Organic carbon[b]	Exchangeable cations[c]			Cation exchange capacity	Base saturation	Particle size distribution			Volume weight	Permeability	
				Ca	Mg	K			Sand 2-.05 mm.	Silt .05-.002 mm.	Clay <.002 mm.		In alfalfa field	In corn-field
	in.		*pct.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*me./100 gm.*	*pct.*	*pct.*	*pct.*	*pct.*		*in./hr.*	*in./hr.*
A	0-15	6.5	1.30	29.5	10.1	.6	47.0	88	.8	42.1	57.1	1.35	1.33	.02
GB	15-25	7.0	.92	30.2	11.6	.4	48.0	90	.6	41.4	58.0	1.34	1.49	.02
GB	25-32	7.4	.67	30.0	12.2	.4	46.5	94	.6	42.1	57.3	1.36	.01	.02
GB	32-44	7.5	.52	29.7	12.5	.4	46.1	95	.6	42.6	56.8	....	....	...
CG	44-55	7.8	.41	34.3	12.4	.4	49.6	98	.5	43.3	56.2	....	....	...

[a] Profile samples taken in Lawrence county, Township 2 north, Range 12 west, Section 8, southwest quarter, northeast 40 acres, northeast 10 acres.

[b] Percent organic carbon times 1.724 = percent organic matter.

[c] One me. of Ca (calcium) per 100 grams of soil = 400 pounds per acre or per 2 million pounds of soil.
One me. of Mg (magnesium) per 100 grams of soil = 240 pounds per acre or per 2 million pounds of soil.
One me. of K (potassium) per 100 grams of soil = 780 pounds per acre or per 2 million pounds of soil.

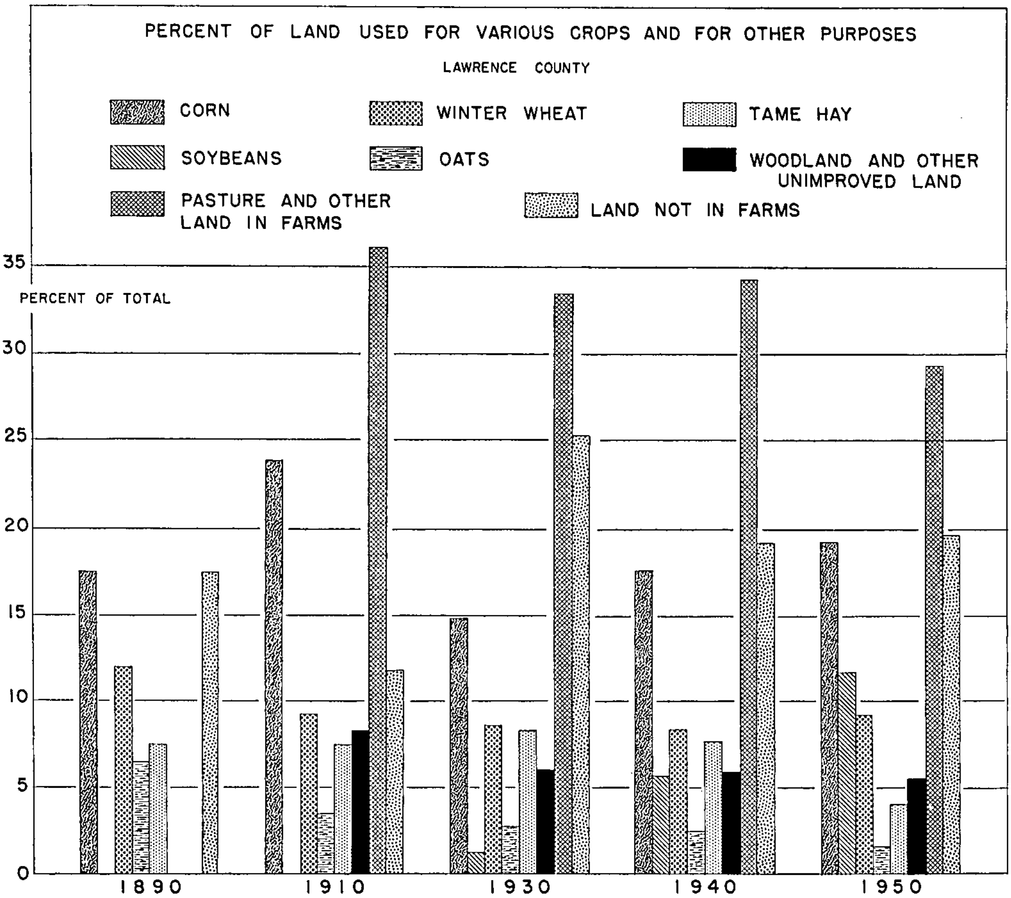
whereas Landes varies from light to moderately dark colored.

The two remaining soils of Association J, Wabash and Darwin, are both naturally very poorly drained, low-lying, fine-textured (silty clay or clay) soils. Wabash is dark colored and Darwin is moderately dark colored. Many areas of these two soils in Lawrence county are still swampy since they are often difficult to drain and cultivate.

Some physical and chemical data for Darwin clay are given in Table 18. The particle size distribution in Table 18 shows that this profile is a silty clay but nearly a clay. This soil has one of the very highest cation exchange capacities of any Illinois soil analyzed to date.

AGRICULTURAL PRODUCTION AND CLIMATE

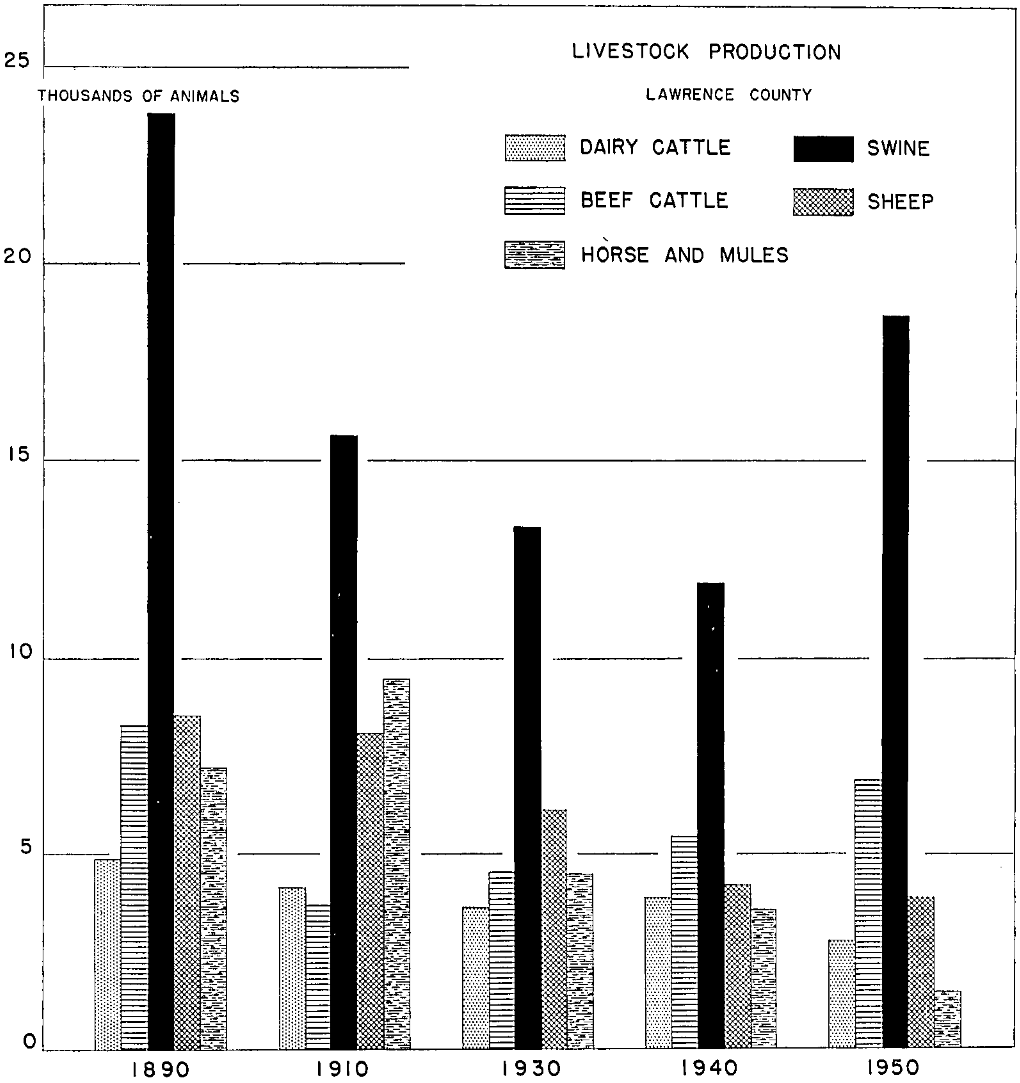
Crop acreages and livestock numbers. Lawrence county is mainly agricultural, although oil is an important industry. According to U.S. Census data, about 75 to 85 percent of the total area of the county has been in farms since 1890. The upland areas, which lie between about 440 and 640 feet above sea level, are used mainly for corn, soybeans, wheat, hay, and pasture. The terrace



Figures on the percent of land in pasture and in woodland and other unimproved land were not available for 1890. Soybeans did not put in an appearance until 1930, but since then the acreage has greatly increased. (Fig. 30) soils are used mainly for cropland, with a high percentage of wheat being grown on the Allison prairie area between Lawrenceville and Vincennes, Indiana. Bottomlands are used mostly for corn and soybeans.

The percentages of land in Lawrence county used for various crops and other purposes are given in Fig. 30. The acreages of corn and wheat have remained fairly constant over the years. The acreage of oats has shown a steady decline, whereas soybean acreage has increased almost ten times since 1930. The acreage of tame hay was fairly constant from 1890 to 1940 but declined in 1950.

Livestock numbers were lower in 1950 than in 1890 (Fig. 31). Dairy cattle, sheep, and horses and mules have shown gradual downward trends with minor



Besides the great and to-be-expected decline in horse and mule population, the numbers of dairy cattle and sheep have decreased since 1890. Beef cattle and swine were both at their peak in 1890 and at their second highest in 1950. (Fig. 31)

exceptions over the years. Beef cattle numbers were at a peak in 1890 and a low in 1910. Since 1910 they have gradually increased in number. Swine numbers were highest in 1890 and second highest in 1950 with a low in 1940.

Climate. Data from the Olney weather station in Richland county over the period from 1897 through 1944 show that for the Lawrence county area the mean July temperature was 78.1° F. and the mean January temperature was 32.1° F. The average date of the last killing frost in the spring was April 17 and the average date of the first killing frost in the fall was October 20. Thus the average growing season was 186 days.

The average annual rainfall from 1887 through 1946 was 40.81 inches, with a low of 25.56 inches in 1936 and a high of 63.75 inches in 1945. Average snowfall from 1899 through 1944 was 17.2 inches. The average rainfall from 1921 through 1946 during the growing season, April through September, was 23.08 inches, with a low of 9.81 inches in 1936 and a high of 36.75 inches in 1945.

MEANINGS OF SOME TECHNICAL TERMS

Alluvial sediment — particles of matter of different size carried by running water and left on the flood plains.

Calcareous — said of soils containing enough limestone to effervesce, or bubble, when dilute hydrochloric (muriatic) acid is poured on them.

Claypan — compact soil horizon high in clay content and having a rather abrupt textural change from the overlying horizon.

Colluvial — said of soils which are formed from material that has been washed or moved short distances down slope.

Compact — said of soils that are difficult to penetrate, being made up of particles so closely packed that there is relatively little pore space between them.

Concretions — small hard nodules, or lumps, of mixed composition, shapes, and coloring (limestone concretions and dark rounded pellets of iron-manganese are common).

Depressional — said of soils that occur in low-lying areas that have either no surface outlets for the water that 'accumulates or only poorly developed outlets.

Drift — *see* Glacial drift.

Free lime — natural lime mixed with the other soil material, making soils calcareous (*see* calcareous above).

Friable — easily crumbled or crushed in the fingers; a desirable physical condition in soils.

Glacial drift — any material carried by the ice or waters of glaciers and deposited either as layers of particles sorted by size or as mixed materials.

Glacial till — mixed materials deposited by glacial ice and not laid down in layers.

Horizon — *see* Soil horizon.

Leached — dissolved and washed out of or down through the soil. This has happened with the more soluble materials, such ,as limestone.

Leguminous — a term applied to plants that, through bacteria on their roots, have the power to take nitrogen from the air.

Loess — fine dust or silty material transported by the wind and deposited on the land. In the Midwest the loess is largely of glacial origin. The grinding action of the glacial ice reduced great quantities of rocks to "rock flour." This fine material was, for the most part, deposited as sediment by glacial streams in their flood stage. Later, during dry periods, it was picked up by the wind and deposited on the surrounding areas.

Mapping unit — as used here a mapping unit is a subdivision of a *soil type* having limited range in *slope* and limited range in *thickness of remaining surface and subsurface soil,* but having a large enough area to be shown on the soil map.

Neutral — a neutral soil is one that has neither an acid nor an alkaline reaction.

Outwash, glacial outwash — sediment, often sandy and gravelly, deposited in layers in valleys or on plains by water from a melting glacier.

Parent materials — geological deposits and formations, such as rock, till, loess, etc., from which soils develop.

Percent slope — the slant or gradient of a slope stated in percent; for example a 15-percent slope is a slope that changes 15 feet in elevation for each 100 feet horizontal distance.

Plastic — said of soils that, when moist, are capable of being molded or modeled without breaking up; an undesirable condition, the opposite of friable.

Plowsole — a dense, compacted layer of soil just beneath the surface which interferes with root penetration and the movement of air and moisture.

Profile — *see* Soil profile.

Siltpan — compact soil horizon high in silt and relatively low in clay content. When dry, it is very hard and brittle. When moist, the apparent cementation disappears.

Soil complex — two or more soil types that occur together in a more or less regular pattern, and are so intimately associated geographically that they cannot be separated by boundaries on the soil map at the scale used.

Soil horizon — a term used for a natural structural division or layer of soil parallel to the land surface and different in appearance and characteristics from the layers above and below it.

Soil profile — a vertical section of soil through and including all of its horizons.

Soil structure — the arrangement of individual soil particles of sand, silt, and clay into larger, variously shaped aggregates or clusters. Among the types of soil structure are the following:

Blocky — shaped like a cube or block with sharp angles between the sides of the cube; three dimensions about equal.

Platy — platelike with the vertical dimension much smaller than the other two.

Prismatic — similar to blocky but with the vertical dimension greater than the other two. Angles between the sides or faces of the prismlike clusters are sharp.

Nutlike — shaped like a nut. Somewhat similar to blocky but more rounded; three dimensions about equal.

Till — *see* Glacial till.

Topography — the lay of the land surface; as rolling topography, nearly level topography, etc.

Weathered — disintegrated and decomposed by the action of natural elements, such as air, rain, sunlight, freezing, thawing, etc. Weathered soils are soils that have been leached and changed physically and chemically.

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* No longer available for distribution.
** Reports No. 74 for Iroquois county and No. 72 for Livingston county replace Nos. 22 and 25 previously published for these two counties.

Much new information about soils has been obtained since the older soil maps and reports in the above list were printed, especially Nos. 1 to 53, which were issued before 1933. For many areas this newer information is necessary if the maps and other soil information in the reports are to be correctly interpreted. Help in making these interpretations can be obtained by writing to the Department of Agronomy, University of Illinois, Urbana.

WHAT KINDS OF SOIL OCCUR ON MY FARM?

WHAT TREATMENTS DO MY SOILS NEED TO MAKE THEM YIELD THEIR BEST?

WHAT CROP YIELDS CAN I EXPECT?

This Soil Report aims to answer these, as well as other questions for the farmers and landowners of Lawrence county. Careful reading will repay all who own or operate farms in this county. . . .

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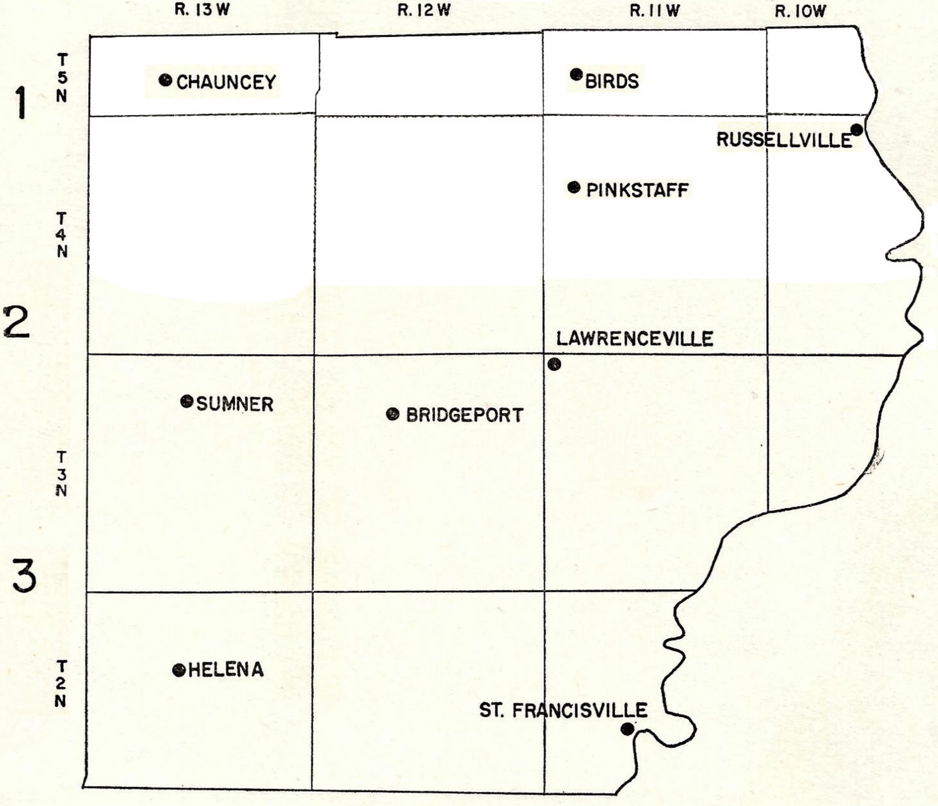

LAWRENCE COUNTY SOIL MAP

LEGEND

2	Cisne silt loam
3	Hoyleton silt loam
4	Richview silt loam
5	Blair silt loam
8	Hickory loam
8-14	Hickory loam — Ava silt loam, complex
8-214	Hickory loam — Hosmer silt loam, complex
8-308	Hickory loam — Alford silt loam, complex
12	Wynoose silt loam
13	Bluford silt loam
14	Ava silt loam
46	Herrick silt loam
50	Virden silty clay loam
53	Bloomfield fine sand
70	Beaucoup silty clay loam, bottom
71	Darwin clay, bottom
72	Sharon loam, bottom
75	Drury silt loam
83	Wabash silty clay, bottom
88	Hagener loamy sand
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253	Stonington soils
284	Tice silty clay loam, bottom
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287	Chauncey silt loam
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A	0 to 1.5% Slope
B	1.5 to 4% Slope
C	4 to 7% Slope
D	7 to 12% Slope
E	12 to 18% Slope
F	18 to 30% Slope

- School
- Church
- House
- Store

Slope symbol followed by + sign (for example, A+) — Light colored, silty sediment, 8 to 15 inches thick, deposited on a normal surface soil.

Slope symbol alone (for example, C) — None to slightly eroded (over 7 inches of surface and subsurface soil remaining).

Slope symbol overscored (for example, $\overline{C}$) — Moderately eroded (3 to 7 inches of surface and subsurface soil remaining).

Slope symbol underscored (for example, $\underline{C}$) — Severely eroded (less than 3 inches of surface and subsurface soil remaining).

- Paved road (two lane)
- Graveled or oiled road
- Blacktop and one lane paved road
- Improved dirt road
- Secondary dirt and private road
- Railroad
- Township boundary
- County boundary
- State boundary

- G.P. Gravel pit
- B.P. Borrow pit
- Cemetery
- Swamp
- Pond
- Flowing stream
- Uncrossable drainageway
- Crossable drainageway
- Levee

Scale

0 ¼ ½ 1 2 miles

1951

William D. Shrader, Senior Soil Correlator
United States Department of Agriculture

R. T. Odell, in charge of Soil Survey
University of Illinois Agricultural Experiment Station

Soils Surveyed by J. B. Fehrenbacher, in charge, E. G. Knox, M. M. Mortland, W. R. Oschwald, B. W. Ray, and R. H. Rust, University of Illinois Agricultural Experiment Station.

SOIL SURVEY MAP OF LAWRENCE COUNTY, ILLINOIS

UNIVERSITY OF ILLINOIS AGRICULTURAL EXPERIMENT STATION

in cooperation with

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE AND BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

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Swamp
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304	Landes fine sandy loam, bottom
305	Palestine loam
306	Allison silty clay loam, bottom
307	Iona silt loam
308	Alford silt loam
309	Keytesville silt loam
331	Haymond silt loam, bottom
332	Billett sandy loam
333	Wakeland silt loam, bottom
334	Birds silt loam, bottom
382	Belknap silt loam, bottom

A	0 to 1.5% Slope
B	1.5 to 4% Slope
C	4 to 7% Slope
D	7 to 12% Slope
E	12 to 18% Slope
F	18 to 30% Slope

School
Church
House
Store

Slope symbol followed by + sign (for example, A+) — Light colored, silty sediment, 5 to 15 inches thick, deposited on a normal surface soil.

Slope symbol alone (for example, C) — None to slightly eroded (over 7 inches of surface and subsurface soil remaining).

Slope symbol overscored (for example, $\overline{C}$) — Moderately eroded (3 to 7 inches of surface and subsurface soil remaining).

Slope symbol underscored (for example, $\underline{C}$) — Severely eroded (less than 3 inches of surface and subsurface soil remaining).

Paved road (two lane)
Graveled or oiled road
Blacktop and one lane paved road
Improved dirt road
Secondary dirt and private road
Railroad
Township boundary
County boundary
State boundary

Gravel pit
Borrow pit
Cemetery
Swamp
Pond
Flowing stream
Uncrossable drainageway
Crossable drainageway
Levee

Scale
0 ¼ ½ 1 2 miles
1951

William D. Shrader, Senior Soil Correlator
United States Department of Agriculture

R. T. Odell, in charge of Soil Survey
University of Illinois Agricultural Experiment Station

Soils Surveyed by J. B. Fehrenbacher, in charge, E. G. Knox, M. M. Mortland, W. R. Oschwald, B. W. Ray, and R. H. Rust, University of Illinois Agricultural Experiment Station.

SOIL SURVEY MAP OF LAWRENCE COUNTY, ILLINOIS

UNIVERSITY OF ILLINOIS AGRICULTURAL EXPERIMENT STATION

in cooperation with

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE AND BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING